SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES

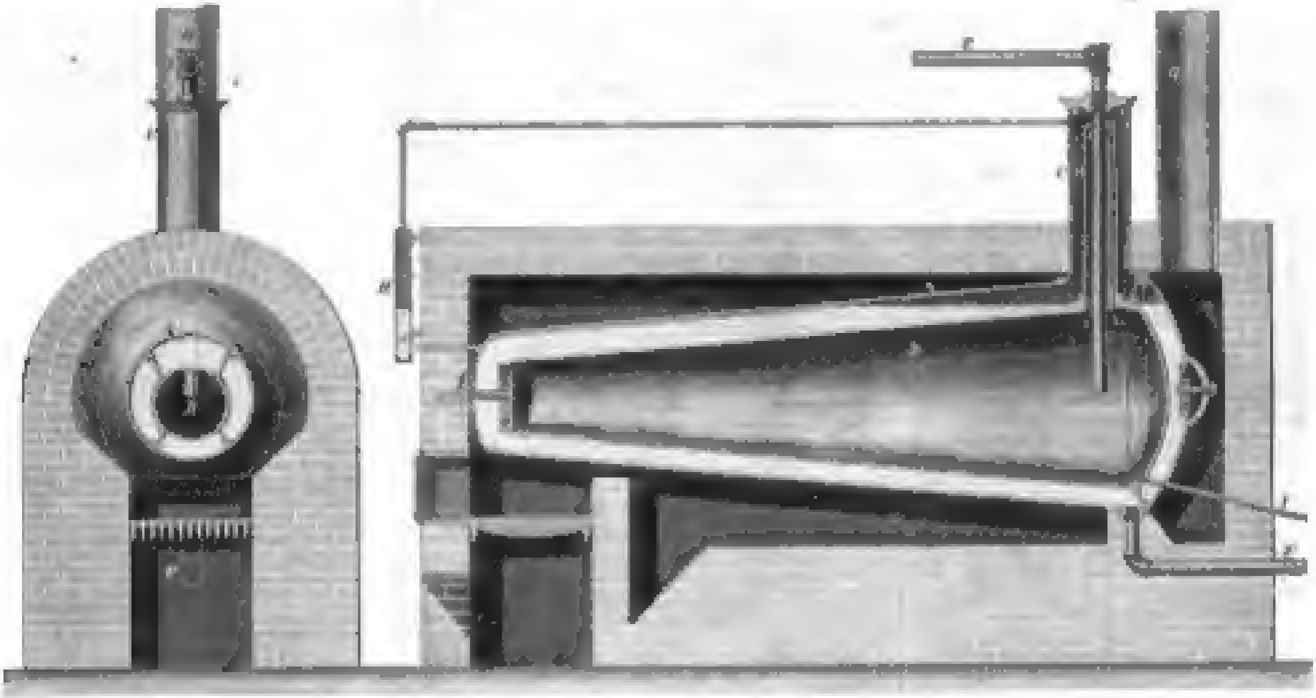
Vol. XX.—No. 7. [NEW SERIES.]

NEW YORK, FEBRUARY 13, 1869.

$3 per Annum. [IN ADVANCE.]

Improvement in Steam Generators.

When it is considered that only a small percentage of the heating properties of coal, when released by combustion, are made available for the production of mechanical power, it is evident that any improvement that will increase the ratio of the power delivered, as compared with the fuel consumed, is a valuable one. This object has been sought for years by engineers and inventors, who have experimented upon almost every conceivable form of boiler and arrangement of its parts.



THE GORMAN PATENT BOILER.

At the Fair of the American Institute, held in New York in the fall of 1867, a new form of boiler, known as the "Gorman," from the name of the patentee, attracted great attention, especially among practical men, for its peculiarities of internal structure and its apparent extraordinary results. We publish herewith representations of this boiler in three forms—stationary, portable (both horizontal) and upright.

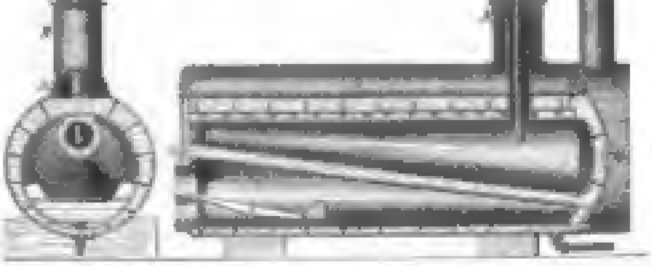
Fig. 1 is the stationary boiler, one view being a longitudinal section, and the other a transverse vertical section near the front end through the fire box. The boiler proper consists of two cone like shells, one inside the other, leaving a space between the two of several inches, varying according to the dimensions of the boiler, which is almost entirely filled with water, completely enveloping the inner cone, as will be seen by reference to the engraving. The interior of the internal shell is wholly devoted to steam, which is thus enveloped with a non-conducting material. A reference to the parts by the following letters and the arrows will render unnecessary a detailed description: A is the outside shell; B, the steam reservoir; C, the steam dome; D is the pipe conducting the steam to the reservoir, B; E, the outlet, or delivery pipe; F, the feed water and blow-off pipe; G, the chimney; H, the water gage on front of the boiler; and I, the pipe for testing the dryness of the steam, leading from steam reservoir.

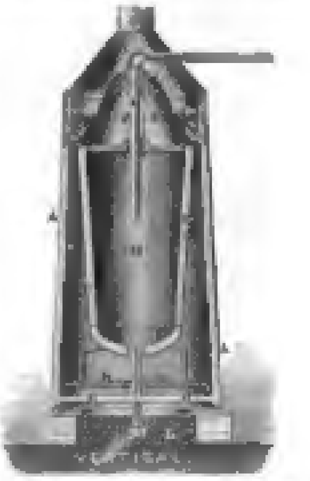
Fig. 2 shows similar sections of the portable horizontal boiler. We gave a brief description of this boiler on pp. 338-9 in No. 13, Vol. XVII, SCIENTIFIC AMERICAN. This differs somewhat in its details from the stationary, which is set in brick work. The outer shell is simply a cylinder like that of an ordinary cylindrical boiler, but double, both sides and ends affording a water space, as seen in the engravings. Inside this shell are the two cones, so placed, however, that the upper surface stands on a level. The outer cone is not entire but is open at the top along its whole length, and surmounted with a longitudinal dome A. This arrangement gives communication between the space between the two walls of the outer shell and that between the two cones, both being water spaces. B is the steam dome similar to that on the stationary boiler, and the other parts and appendages will be understood by a reference to corresponding parts in that engraving.

Fig. 3 represents the vertical form of this boiler, and the following letters of reference will explain its construction fully: A, first cylindrical shell; B, second shell; C, third shell; D, steam reservoir; E, dome; F, connecting pipe into D; G, outlet or steam pipe; H, water connection pipes; I, steam connection pipes; K, grate; L, ashpit; M, feed and blow-off pipe; N, brackets; O, smoke box; P, chimney.

It will be seen that the objects intended by this improved form of boiler are perfect circulation of the water, quick and even generation of steam, entire combustion of the fuel, utilization of the heat evolved, dry steam, and prevention of unequal heating and consequent expansion of the material of the boiler. The arrangement, form, and construction of the parts as shown in the engravings will enable any practical man to decide as to the success attained in the objects sought.

Fig 2





The form of the interior cylinder, or cone, and its position, as regards the fire, the protection of the steam by a water jacket from atmospheric influences, seem to insure equable heating of the water-containing surfaces and pure dry steam. The inventor claims an evaporation of over twelve pounds of water to one pound of coal consumed, and one horse power of effective force yielded by from four to eight square feet of heating surface according to size. These claims seem to be established by experiments witnessed and substantiated by practical engineers. Among those who have given their approval to this boiler are Edward Faron, superintendent of the Morgan Iron Works, and Charles H. Haswell, formerly chief engineer U.S. Navy; W. W. Wood, U. S. Navy; W. Vanderbilt, Pacific Mail Steamship Company, and J. H. Lewison, of the U. S. Revenue Service—these three last, judges of steam boilers at the Fair of the American Institute—T. W. Kennard, of the Atlantic & Great Western R. R. and many other engineers who speak, in their reports of experiments which they witnessed or conducted, in the highest terms, of the boiler and its performances, fully substantiating all the claims made by the inventor, Capt. Gorman. This style of boiler is adapted in its form and application to marine and land service, to stationary and locomotive purposes; indeed, to all situations in which steam boilers can be used either for generating steam for power or heating purposes.

The engravings of marine and locomotive boilers are reserved to a future number.

The United States patents bear dates July 28, 1863, and January 21, 1868. Patented also in the principal European countries. Further information may be obtained by addressing Kasson & Co., General Agents, 119 Broadway, or P. O. box 3,185 New York city. See advertisement on last page.

THE MANUFACTURE OF BRONZE POWDERS.

Prepared for the Scientific American.

The waste material of the beating of metals (an art which took its rise in the fourteenth century, in Nuremberg, Germany) was thrown away till 1750. In that year a monk in Fuerth, by the name of Huber, conceived the fortunate idea to grind this material called "Schabig" on a stone, and to sell the metallic powder thus obtained as a color. The goldbeater Martin Holzinger succeeded subsequently in imparting to the powder various lusters by exposing it to different degrees of heat; and in 1781, Courtier, a Frenchman, discovered the mode of preparing gold bronze from leaves, consisting of an alloy of zinc and copper. Although this bronze powder was offered for one florin (fifty-one cents, currency) per pound, it was but little in demand; but since the preparation of various colors, from red down to nearly white, is no longer a secret, the manufacture of bronze powders has attained considerable importance, and is now practiced in several towns in Bavaria and Westphalia, and in the capitals of France and England. The refuse of goldbeating being no longer sufficient, special alloys are flattened. When in Fuerth, Bavaria, in 1854, we counted not less than fourteen bronze powder establishments. In Munich and Nuremberg the value of this article is said to reach yearly $600,000 in currency.

The process of flattening metals for the purpose of reducing them into powder is carried on in a manner similar to that of goldbeating. When obtained in a thinness so as to permit the transmission of the rays of light, the leaves are rubbed through an iron sieve of exceedingly small holes by means of a wire brush, the powder thus produced is then allowed to pass through a mill under addition of some oil, and finally it is heated to a certain degree, according to the color desired.

Prof. Wagner, a chemist well known in this country, has ascertained that all bronze powders consist chiefly of a fatty matter, oxygen, copper, and zinc. The composition used for light shades consists of 82 per cent of copper and 18 per cent zinc; for deep ones, of 84 to 90 copper, and 6 to 16 zinc; for copper red, pure copper is used. The amount of copper in various colors was found to be the following:

In French copper red, 97·32 per cent; orange, 94·44 per cent; light yellow, 81·29 per cent.

In English orange, 90·82 per cent; deep yellow, 82·37 per cent; pale yellow, 80·42 per cent.

In German copper red, 99·90 per cent; violet, 98·92 per cent; orange, 95·30 per cent; deep yellow, 81·51 per cent; lemon, 80·34 per cent.

Wagner discovered a small percentage of iron in the English bronze, but tin, silver and nickel, or cobalt, arsenic and bismuth, as often asserted, were not met with in any.

Recently various methods have been suggested in order to avoid the dividing of the metal leaves by means of a brush. They are partly founded on mechanical, partly on chemical principles. It was, for instance, attempted to prepare the powder by means of files, but it was discovered to be angular and without luster. When, however, passed through rollers, it gained its original luster again. In Germany, this method has not met with any approval, but it is said to be employed in England.

In 1850, Brunning proposed to divide metals in their melted state by means of a centrifugal machine, and Parke asserted that he succeeded in preparing bronze powder by amalgamation. The highly injurious effects of mercury vapors do, however, not allow the introduction of this latter method.

Copper powder may be prepared chemically in various ways which results in forming, with one single exception, crystalline and brittle products, which, in crushing, are converted into a dull powder. In reducing oxide of copper with rhigolene and gasoline, the two lightest products of the distillation of petroleum, Prof. Wagner, for the first time, obtained copper in minute scales. In conducting the process it is necessary that the metal be left to cool in the vapors of those hydrocarbons. The bronze color is thus obtained is somewhat dark, but may perhaps be changed into brighter hues, by passing vapors of zinc or cadmium over them. In one instance where gasoline containing sulphur was used, the copper bronze exhibited a fine iridescent appearance.

It is only within the last decade that various substitutes for the above described bronze powders have been brought to the notice of consumers. We mention

1. *The Tungsten bronze.* Of these the "tungstate of oxide of tungsten and soda" is the most important. It forms beautiful crystals of a golden-yellow color and gold luster. The potassa salt, discovered by Laurent, forms violet needles with copper luster, and possesses great similarity with sublimed indigo. The lithium salt appears in prismatic scales and leaves of the color of slightly tempered steel. In glowing the potassa salt, a brilliant dark blue steel color may be obtained. The tungsten, or wolframium bronzes first appeared at the World's Fair in London, in 1862, and they then attracted considerable attention. The soda compound appeared under the denomination of saffron bronze, the potassa compound under that of magenta bronze. At the exhibition at Paris, in 1867, these bronzes were only present in small quantities. The reason for this fact is stated by Prof. A. W. Hofman as follows:

"It appears, that in order to cover well, and reflect the light with intensity, it is necessary that the smallest particles of the bronze powders should possess the property to split in lamellæ. If their crystalline structure shows this glimmer-like character, their covering capacity remains the same when reduced to a finer state. If these bodies, however, crystallize in cubes, they are in being crushed, not reduced into lamellæ but again in cubes. A certain quantity of such a powder covers a much smaller surface, than an equal weight of bronze consisting of scales. They also reflect the light not in the same degree as purely metallic bronzes."

2. *The tin bronze, or Mosaic gold.* This variety may, as regards brilliancy, well compete with the lighter bronze colors. It is also more durable. Kletzinski proposes to prepare it, by sublimating the amorphous sulphide of tin, which is obtained in boiling a tin-salt solution with dilute oil of vitriol and saturating the liquid with the gas of burning sulphur. The sulphid of titanium also deserves attention; it forms scales of a brass color.

3. *Chromium bronze, or chloride of chromium,* forms brilliant violet flakes, which, in transmitted light, appear blood red. It may be rubbed into the skin like all bronzes.

4. *Crystallized iodide of lead,* a beautiful yellow substance, is proposed for decorative purposes; gold inks, shell-colors, as a mass for pencils, for the painting of fabrics, wall paper, for filling glass pearls, etc.

5. *Organic bronze colors.* To these belong the derivatives of the haematoxylin, already extensively employed in the manufacture of bronze paper, the numerous tar-pigments, of which the corallin is one of the most recent discoveries, the murexide and the green hydroquinon.

◆

The Latest Novelty in Electricity—Non-existence of the Electric Fluid.

(Abstract of a Lecture given before the Rensselaer Polytechnic Institute, Troy, N. Y., by Prof. Vander Weyde, M. D.)

"In the same manner that the investigations and discoveries of twenty years ago have proved that the so-called caloric fluid has no existence, and that heat is only a mode of matter—a mode of motion of its particles; so the investigations of the present day prove that the so-called electric fluid has no existence, and that even electricity is nothing more than a state of matter—another mode of motion of its molecules. Without matter there is no electricity, as will be proved by this little glass tube, in which the vacuum is so perfect that no electricity can possibly pass through it, notwithstanding the ends of the two platinum wires sealed in the glass and projecting outside on both ends, and which conduct the electricity inwardly, are only one quarter of an inch apart. I have here a similar tube filled with common atmospheric air, the ends of the wires are also one quarter of an inch apart, and may be separated a half or a whole inch, but the electric current will be seen in the form of sparks to pass easily between the wires, and to charge this Leyden jar. I have here also a so-called Geissler tube, in which the ends of the wires are separated to the distance of twenty inches, and through which the electric current could not pass at all while filled with air; but the air in it is rarefied to such a degree as to make it a good conductor of electricity, and you see the current pass not in sparks, as in the second tube filled with common air, but as a glowing fire, resembling the northern light; through this tube also we can charge this Leyden jar. Through the first tube, in which, by great precautions, an almost perfect vacuum has been produced, there is not only no current seen to pass, but it is impossible to load this Leyden jar when the tube is interposed between the jar and the machine developing the electricity.

The verification of the passage or non-passage of the electric current by means of this charge in the jar, obtained or not obtained, is important, as otherwise it would be doubted if the electricity passed invisibly through the vacuum.

This striking and novel experiment, demonstrating the impossibility that an electric current can overleap a really empty space, even to the small distance of only one quarter inch, proves that there are two errors in our present theory of electricity. First, that the transmission of electricity in vacuo, so-called, is really a transmission through rarefied air or gas, these being good conductors; common air, we know, is a bad conductor. The vacuum is proved by this new experiment to be an absolute non-conductor. Secondly, this experiment proves that if that which we call electricity was really a fluid distinct from common matter, there is no reason why it should not overleap the small empty space of a quarter of an inch. As we see, however, that electricity cannot possibly overleap that small space, nor be transmitted where no matter exists, we are forced to the conclusion that the phenomena of electricity are not due to a peculiar fluid, which moves rapidly through conducting media, but that the propagation is effected by peculiar motions of the molecules, which, being rapidly transmitted from molecule to molecule in the conducting body, form that which we call electric currents. In short, that electricity is transmitted like sound, by some kind of waves, undulations, or vibrations, only with much greater velocity. In fact, there exists as little necessity to adopt a special electric fluid to explain the electric phenomena, as there exists to adopt a special sonorous fluid to explain the acoustic phenomena.

◆

Opals—Chalcedony—Economy in Using Coal.

The Lyceum of Natural History met, January 18th, at its rooms, Madison avenue. Numerous donations of pamphlets and reports were presented.

Dr. Dalley showed some specimens of chalcedony which had been found in Honduras, on the border of Guatemala, by a friend of his, who, when riding over a section of that state, was attracted by red objects on the ground, which he took to be fruit. On examination, he found that they were pieces of chalcedony.

Mr. E. G. Squier supposed that these specimens were found in the neighborhood of the opal region. Being answered affirmatively, a conversation sprung up about opals, Mr. Squier remarking that he had found many specimens of opals in the region alluded to. They generally occurred in pockets formed, as it were, by the roots of trees. He presumed the matter of which they were formed had filtered through. In answer to a question about the value of the Honduras opals, he stated that an English company engaged in collecting them was making large returns on its capital.

Dr. Feuchtwanger mentioned some instances in which persons similarly engaged had not met with a similar good fortune. He also mentioned cases to show that opals often deteriorated in cutting, and that very few valuable opals could be secured. He knew of a large opal in London which, when rough, was valued at £3,000, but which, when polished, brought only half that sum.

Mr. E. G. Squier explained how so many opals were found fractured. The Indians who collected them worked in bands. When they found an opal it was placed under a hammer and broken, each member of the band taking his share. He gave the history of an opal possessed by a friend of his, which was considered the largest in the world. It was, unfortunately, broken in polishing. The larger piece was polished, and sold to the wife of the Captain-General of Cuba, Serrano, for a large sum.

Professor Eggleston, of the School of Mines, stated there were two kinds of opal, the Mexican, or soft opal, and the precious opal, which retained its luster for a century. He had noticed a curious property of these stones, viz.: that the Mexican opal showed its "fire" according to the dampness of the season, being dull in dry weather. The effect of putting a drop of water on the stone was to make it quite iridescent. The peculiar appearance of the stone was caused by the decomposition of light in its microscopic fissures. He was not prepared to state what effect the action of the water had on this decomposition. It was certain it had some. In fact, he considered it indubitable that the opalescence, under the circumstances he mentioned, was caused by hydration. In the precious opal the fire was lost by handling. He had been engaged on some experiments to ascertain how it might be restored. Heating would not do. He had found alkaline solutions useful in restoring it. He had used cyanide of ammonia with good effect.

Professor Eggleston further explained how it was possible to impart this peculiar iridescence to plaster. The iridescence was to be accounted for by either of two causes. It was caused by superficial oxidation, which disappeared when scratched. It was also caused by the decomposition of light by means of the microscopic fissures alluded to. Both at Berlin and in Washington the iridescence had been transferred to plaster.

Dr. Newberry (in the chair) pointed out that fractured glass possessed this property of decomposing light, which was also common to substances formed in lamina, such as a certain sea-shells. Mr. Rutherford had cut on glass microscopic lines 7,000 to the inch, and these were iridescent. A friend of his had informed him that the Honduras opals were found in veins in trachytic rock. The largest he had ever seen was in the possession of Mrs. Aspinwall, of this city.

Professor Newberry exhibited a concretion, spheroidal in form, and presenting a curious appearance at one pole, which he regarded as quite puzzling. He mentioned the fact that in the subcarboniferous system of Kentucky he had found numerous siliceous concretions of a very singular form.

Professor Joy presented some of the refuse of refined sugar from the Hudson River Sugar Refinery. He proposed to ascertain by the spectroscope whether there was any cæsium or rubidium in it. He called attention also to the invasion of the salt mines of Wieliczka near Cracow by water, supposed to be from a subterranean lake. The water had already risen as far as the famous chapel of St. Anthony, cut from the solid salt, in 1698. The people were leaving the neighborhood for Cracow.

Professor Newberry announced the death of two distinguished naturalists, Dr. Carl Frederick Philipp Von Martius, Professor of Botany in the University of Munich, and Mr. John Cassin, of Philadelphia, another well-known scholar. Professor Newberry spoke in high terms of the scientific labors of the deceased gentlemen.

Professor Eggleston spoke of some of the furnaces adapted to economize coal, and in the course of some very interesting remarks he pointed out that when coal contained a greater quantity of ash than twelve per cent, it was useless for metallurgical purposes. The large proportion of ash in coal was due to the presence of silicate of alumina. It had been found that by crushing the coal and washing it, a large portion of this silicate might be removed, and the coal fitted for coking.

A conversation ensued, in which Dr. Newberry spoke highly of the Western coals as particularly free from ash, containing in many instances as little as two per cent. The Nova Scotia coals contained as much as thirty per cent.

Professor Eggleston, on the other hand, remarked that many of the coals taken from the neighborhood of Pittsburgh contained a large portion of ash, hence the importance of the crushing, washing, and coking process.

Professor Seeley and Mr. Walling discussed the ordinary formula given in the school books for momentum, Professor Seeley arguing that the school books were incorrect.

◆

Removing Foul Air from Wells.

A correspondent gives us an account of an ingeniously extemporized apparatus for removing carbonic acid from wells. It was simply an umbrella let down and rapidly hauled up a number of times in succession. The effect was to remove the gas in a few minutes from a well so foul as to instantly extinguish a candle previous to the use of the umbrella.

◆

A species of dwarf fossil elephants has been discovered in the island of Malta by Mr. Busk. According to a communication made by him to the British Zoological Society its height is only from two and one-half to three feet. Another species previously discovered by Dr. Falconer had a height of only four and one-half feet.

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Superheated Steam.

MESSRS. EDITORS:—In No. 4, current volume of the SCIENTIFIC AMERICAN, it is stated editorially that "ordinary steam is saturated, mechanically suspended, a large amount of water, it [illegible] Superheating or additional heating sufficient to convert [illegible] steam, pure and simple, is undoubtedly economical, if it can be done [illegible] such an expenditure of fuel as to neutralize its economy." Having given much attention to the subject, and from an experience of three years in the practical use of superheated steam for many purposes, I have found it to be economical and otherwise beneficial under all circumstances. Of course, the less the cost of the superheating, the greater will be the gain, but this is always considerable, though variable.

I can also assert that where such steam is properly used, it is impossible for it to exert any injurious influence (but quite the reverse) upon the working surfaces of the engine. A blessing, however great, may become a curse if misapplied, and superheated steam, like the elements, though a good servant, is a bad master. Steam superheated directly to 400 deg. as a maximum, or mixed, so as to have that temperature, is entirely beneficial in its action, as it keeps the cylinder free from water, which is a nuisance for many obvious reasons.

The full economy due to the expansion of steam can only be realized by superheating, which prevents the excessive condensation occurring under such circumstances. Experiments made by Messrs. Geo. Hooker & Waterman in this city (see SCIENTIFIC AMERICAN, Aug. 18, 1866) with the greatest care, showed that the loss from this source was from 20 to 40 per cent of the total amount of steam used, and these results are confirmed by the application of the indicator to almost any engine. The best results from superheating accrue during the first 80 degrees, when experiment shows that the expansion of the steam from its saturated condition is very great, and after this it follows the law of expansion of gases by heat.

Most of our river, sound, and ocean steamers superheat considerably by means of their steam chimneys and indeed could not obtain the results which they do, without them. Careful thermometrical tests, extending over many weeks, showed that the steam was superheated to 100 degrees in several of these steamers, and to any one who has seen the looking-glass appearance of the interior of their cylinders, the idea that such superheating is injurious, seems wholly impossible.

Steam, as used in manufactories, is almost invariably "wet," containing "spray," unavoidably carried over, or produced by premature condensation. To superheat this steam will save fuel and time in boiling, drying, etc., and often economize dye stuffs and bleaching powders, owing to the liquids being boiled with less increase of water. For refining petroleum and other liquids, superheated steam is substituted for open fire, with advantage, thus reducing the risk from overheating, etc. The power of a boiler, as you remark, cannot be doubled by superheating its steam, but (unless the steam is already superheated) an economy in fuel, etc., of from 12 to 25 per cent. is made by the application of a good superheater; this can be seen in this city and elsewhere. The common defect in superheaters, viz., want of durability, may be overcome by a judicious construction and arrangement; while with a liberal amount of superheating surface, they need not be exposed to a heat which would result in damage and final failure. Many of the heaviest manufacturers and steamship owners in Europe have used superheated steam for years with most economical results, and when its merits are more thoroughly understood, there can be no doubt but that its employment will be general. HENRY W. BULKLEY.

New York city.

Steam from Water and Steam from Maple Sap.

MESSRS. EDITORS:—In No. 4, current volume, under the head of "Increasing the Power of Steam by Superheating," you say that, "Ordinary steam (the vapor given off by boiling water in a closed vessel) contains, mechanically suspended, a large amount of water; it is saturated steam, not pure steam."

I understand by this, that simple steam, say at a pressure of sixty pounds, as it rises, carries with it a large amount of unchanged water which is not steam, and which it fails to precipitate afterwards, or before it leaves the boiler. Every spring, to economize fuel in concentrating the sap of the maple tree to a syrup, I use in my constantly running, factory engine boiler, the sap of the maple instead of pure water, and in this way reducing its volume fifty per cent before drawing it off into my sugar kettles.

Now if the sap is taken up and held in "mechanical suspension" by the escaping steam, am I not the loser of saccharine product just in proportion to the quantity of unchanged sap so carried off? In boiling down a full barrel of the water from the condensed steam of this sap to the volume of a single quart, in the open air, not a trace of saccharine product could be detected in it. If in the first boiler the unchanged sap in large quantities is carried off by the steam, what becomes of its saccharine product if it cannot be found in the steam condensed?

I am preparing for the usual spring sugar-making, but if I am largely the loser by using my factory boiler for partial condensation, I shall this spring return to the old plan of open kettles and wood at $3·00 per cord. Will you be kind enough to advise me which to do. JAS. W. WADSWORTH.

Durham, Conn.

[We did not state that maple sap is "taken up and held in mechanical suspension," but that water was. The reduction of saccharine liquid by boiling under pressure is too common to be the subject of discussion. Cane juice as well as maple juice is thus treated; but to imagine that the saccharine matter is carried off with steam is "begging the question." The specific gravity of sugar is greater than that of water, as is also that of salt. In fact distillation is the only proper way to obtain chemically pure water. Pure water is thus obtained by evaporation. [illegible] not surprising that our correspondent did not find a trace of sugar in [illegible] of condensed steam from a barrel full. He may, however, find [illegible] but his condensed steam from maple sap will be otherwise as pure as that from water.—EDS.

Degree of Heat to Bake Bread.

MESSRS. EDITORS:—It is stated by various authorities, Prof. Horsford among others, that the heat required to bake bread varies from 212 deg. to 400 deg. I do not write this communication to confound the doctors, but having made bread the subject of various experiments for the past three years, and having eaten the fruit thereof with great satisfaction, I am able to say the degree of heat required, is in round numbers, not over 300 deg. to 340 deg. In the statements made by the authorities alluded to, it seems to me that the question of time has not been considered, and that while destructive distillation of the flour, or in other words forming the crust, cannot go on at a lower degree than 400 deg. within a certain time, it can be induced at a lower temperature extending over a longer period. To introduce a loaf of bread to an oven heated to 400 deg., or even 350 deg., would be to burn the exterior hard and dry, while the interior would be "slack." At 600 deg. tin melts, and the result of exposing a loaf of bread one hour to a heat that would melt tin can be imagined.

EGBERT P. WATSON.

A Suggestion for Inventors.

MESSRS. EDITORS:—There are some of your readers, no doubt, who have inventions that would be valuable if brought before the public, but many of them, like myself, are unable to defray the expenses, and therefore do nothing with them, when they might be of value to many of your readers who would be glad to bring them before the public if they possessed means. Now, I propose to all such persons to make their improvements public property by giving a brief description in the SCIENTIFIC AMERICAN. Let those who have plans or improvements of any kind that they cannot avail themselves of, give them to those who can, thereby benefiting mankind. Mind and time are both money. "Give freely of what ye have." I have a plan (it may not be new) for making an automatic musical instrument. It is to have the keys acted upon directly or indirectly by strips of any suitable material with perforations or projections formed in them, and corresponding to the music to be played; said strips of music to be passed through the transmitting or conveying machinery by any desired power with perforations or projections to give motion through the transmitting machinery to the keys of the instrument, and the distance between them to decide the time in the music. A. B. C.

[We suggest, instead of the personal sacrifice, so generously proposed by our correspondent, judicious advertising to attract the attention of possessors of unemployed capital.—EDS.

Tempering Taps.

MESSRS. EDITORS:—Most of your readers are aware of the difficulty in tempering taps and reamers without springing, especially long and large ones. To accomplish this let the blacksmith select his steel for the job and forge the tap with a little more than the usual allowance, being careful not to heat too hot, nor to hammer too cold. After the tap or reamer is forged, heat it and hold it on one end upon the anvil. If a large one hit it with the sledge, if a small one the hammer will do. During this operation the tap will give away on its weakest side and become bent. Do not attempt to straighten it. On finishing and hardening the tap it will become perfectly straight. If any are doubtful a simple trial will convince them. [illegible]

Portland, Me.

Editorial Summary.

WE understand that the Senate Committee have reported in favor of legalizing two bridges over the Connecticut River, one at the mouth and the other further in, known as the Shore Line bridge. This report will meet with very sturdy and persistent opposition in both houses, and its passage at this session is considered doubtful. It always takes a good deal of time to carry such big monopolies, but in the long run opposition gives way.

IT is reported that the employés of the Patent Office cannot get their salaries. From July to December Congress had appropriated $320,000 for current expenses, which have absorbed the sum. During that time the receipts were $[illegible], all of which, by legislation, goes into the Treasury, and though there [illegible] $32,000 in excess of its expenses, not a cent of the same can be applied to pay the clerks. An appropriation will be needed to pay them.

A MILD WINTER has been felt in Europe as well as in this country. The Paris journals in their endeavors to console those who enjoy the ice and chill of winter, state that in 1822, 1807, and, further back, in 1791, the temperature was as unusually warm as it is this year; that in 1659 the Germans never lighted their stoves; that 1617, 1613, 1607 were likewise wonderfully mild; that in 1585 the gardens were full of flowers in the month of January; that in January, 1421, cherries ripened, and grapes in May; and that in 1172 the trees were covered with leaves, flowers bloomed, and birds built their nests, while the little ones fledged in the month of February.

THE Mercantile Library of this city has now 100,000 volumes, embracing the best works on every topic. Popular works are largely duplicated, and about 10,000 volumes are added yearly. The Association has a yearly income of $30,000, and holds real estate valued at $600,000, and books at $150,000; number of stockholders 2,000, and of members 10,000. Reading room is large, well warmed, well-lighted, and supplied with 3,000 books of reference, and over 400 periodicals, foreign and domestic. Young men especially should be encouraged to read books, and to make this a place of resort. It is peculiarly their institution, yet it provides for all. Clerks are charged $3 a year; others $5 a year.

JUSTUS VON LIEBIG, the celebrated German chemist, recently told a friend that, during the last ten years, he had received seven calls from American universities, and that twice he felt strongly tempted to go to the United States and accept there a professorship. We trust that Liebig will visit this country and give our people the benefit of his varied stores of information; but we cannot advise him to cover up his light under the bushel of a college professorship. If the Baron wishes to make his name and fame conspicuously useful he had better accept a position upon the editorial *staff* of the SCIENTIFIC AMERICAN, through whose columns he could teach and educate a hundred thousand minds each week.

SAN FRANCISCO is to be supplied with ice from the summit of the Sierra Nevada, in a very novel way. A party of speculators have constructed an ice-house, capable of holding eight hundred or nine hundred tons of ice, near the Pacific Railroad track. From a stream on the hillside above, a flume has been run to the top of the ice-house, where the water is allowed to fall in small jets or spray into the building below. In this manner they expect to gradually form a mass of solid ice which will fill the entire building.

BRIGHAM YOUNG is said to have a telegraph wire leading to his office and connecting with every hamlet in Utah—a line of 500 miles long. Every settlement of half a dozen houses has a telegraph office with female Saint operators, and in charge of a Bishop of the Mormon church, who can report at any time all that takes place to Young. From his private office in Salt Lake City, like the watchman in the fire telegraph, Brigham may give an order or ring an alarm from Idaho to New Mexico.

A RECENT number of the *Comptes Rendus* states that according to Herr Fritsche, tin exposed to a temperature of 40° below zero was converted into a semi-crystalline mass containing cavities like basalt. In masses of tin weighing from 20 to 60 lbs. these cavities had in some cases, a volume of nearly 24 cubic inches. According to M. Dumas, facts of this kind are not new in Russia; for instance, in one case, the pipes of a church organ were so altered by cold as to be no longer in tune.

AN ENGRAVER congratulates itself upon an invention just out in Paris which should earn for its author the gratitude of millions. It consists of an apparatus, which, applied to any piano, will deaden the sound emitted. There are few persons who have not been sometimes distressed by the practising of some too persevering player, and who would have paid any price for such a "mute" as that described.

THE FRENCH ACADEMY has received a report from M. Duchartre on certain plants which vegetate without water. In South America people suspend such plants from a balcony by a thread, without their being in contact with anything else, and yet they grow and blossom in this strange position. Duchartre tried several experiments to find out how they lived, and decided that they existed by the absorption of water.

A PHYSICIAN writes to the Dublin *Journal of Medicine* in support of the old notion that people sleep much better with their heads to the north. He has tried the experiment in the case of sick persons with marked effect, and insists that there are known to exist great electrical currents, always running in one direction around the earth, and that our nervous systems are in some mysterious way connected with this electrical agent. Let the beds all head towards the north pole.

THE WORK on the artesian well at St. Louis which has been going down for so many years is approaching its close, and a few weeks will determine whether the undertaking is to prove a success or an expensive failure. The drills are now in what is called the pink sandstone, under which lies granite rock. Should the latter be reached without finding water, further attempts will be hopeless.

ARTIFICIAL ICE BLOCKS.—M. [illegible] says that large blocks of ice can be obtained in a few minutes, by producing small pieces of ice at a temperature some degrees lower than zero. These small pieces will then adhere together as soon as they are placed in contact, and blocks of immense thickness can be thus obtained.

A NEW engineering feat is talked of at Chicago. It is proposed to cut off the river several miles above the city, and conduct its entire volume of water to the lake by a canal, and convert the channel into a system of railroads, where all the lines converging in the city might meet in one grand central station.

THE merchants of Bremen have resolved to fit out another Arctic expedition, and place it under the charge of Captain Koldewey, of the Germania. They are to furnish a steamer and defray expenses.

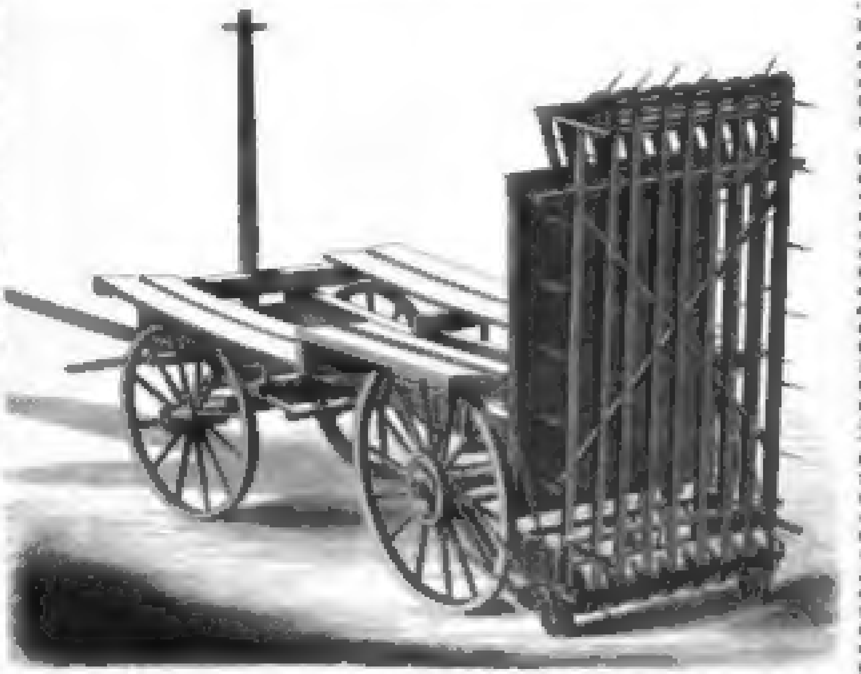
Automatic Hay Loader.

The object of the contrivance shown in the engraving is to gather the crop of hay, already heaped into windrows, without the expense of manual labor in pitching it on the wagon, the only hand work required being that of arranging the hay on the wagon and making up the load.

At the rear of the wagon is attached a frame consisting of a solid apron of boards, at the top of which is a reel extending across the width of the wagon and at a [illegible] sufficient to discharge the hay to make a good load. From this reel extend downward a series of belts armed with rake teeth, the belts passing around a cylinder that receives its rotary motion from the hind wheels of the wagon, by means of a machine chain on each wheel running from a suitable chain pulley on the outside of the wheel, secured thereto, and on to a smaller pulley or wheel connecting by gears with the lower cylinder. All this can be understood by reference to the engraving. The shaft of the lower cylinder is furnished with clutches to prevent its twisting when one of the rear, or driving wheels, turns faster than the other, as in rounding a curve. Sheet iron circular plates are also secured to the bosses of the shaft to prevent the hay from winding around it when the machine is in operation. Under the rear end of the upright frame are small wheels or trucks to keep the lower or driving cylinder from impinging upon the ground when the wheels of the wagon pass into a depression in the surface of the field.

In operation it will be seen that, as the vehicle is drawn along a windrow of hay, the rotating lifting rake is driven so that the hay is swept from the ground inward toward the upright apron, or guard, and discharged by the belts and teeth passing between inclined slats at the top. The gathering frame is properly strengthened by braces, and is so connected with the wagon as to be attached and detached in a moment. The device has received the approval of gentlemen interested officially in the development of agricultural interests and also of practical farmers.

Patented through the Scientific American Patent Agency June 30, 1868, by N. B. Douglas, of Cornwall, Vt. The entire right may be purchased. Address as above.



DOUGLAS' PATENT HAY LOADER.

CHEMICAL CLEANLINESS.

From Chambers' Journal.

One of the most active-minded and ingenious experimentalists in physics, Mr. Charles Tomlinson, has recently called attention to the importance of a chemically clean surface in the performance of many experiments, and to the influence of dirt in modifying their results. His views were discussed in the Chemical Section of the British Association, at the late Norwich meeting, and led to an amusing conversation as to what dirt really is; and the conclusion the philosophers arrived at was, that they could not do better than indorse Lord Palmerston's pithy and comprehensive definition, that "Dirt is matter in the wrong place." Butter, for example, as one of our leading chemists observed, is matter, and very good matter too, in its proper place—namely, a piece of bread; but butter at the end of one's beard is matter in the wrong place, and consequently falls under the category of dirt. In his most recent article on this subject, Mr. Tomlinson defines a chemically unclean surface as "anything that is exposed to the products of respiration, or of combustion, or to the touch, or to the motes and dust of the air, and so becomes covered with a film more or less organic." One of the most important discoveries is, that the supersaturated solutions of a number of salts contained in chemically clean vessels can be kept for a long time without crystallizing, and even be reduced to temperatures much below the freezing point of water, provided they are protected from the motes and dust of the air and other chemically unclean bodies, by closing the mouth of the vessel with cotton wool, which filters the air. Any of our readers can easily repeat this experiment with sulphate of magnesia (Epsom salts), sulphate of soda, or phosphate of ammonia.

The extreme facility with which a chemically clean glass or a water surface may become chemically unclean, is illustrated by the following experiment with the camphor test, which may be thus described: If a few fragments of camphor be scraped from a fresh cut surface, and be allowed to fall upon water, they rotate with extreme velocity, and sweep over the surface, if the water be chemically clean; but if not, the fragments lie perfectly motionless. On a bright and sunny morning, with a dry air, "conditions highly favorable to the camphor motions, which depend as much on evaporation as on solution," Mr. Tomlinson filled four shallow, clean vessels, A, B, C, D, with water from the cistern tap. Camphor was very active on all four surfaces. He put his finger into A, and his tongue into B. Fresh fragments were motionless on A, but active as before on B—showing that the finger was unclean, and that the tongue, instead of depositing a film, absorbed water and any possible film with it. The water was emptied from C, which was refilled from a so-called clean jug from the kitchen, filled from the same cistern tap; but the camphor fragments thrown on C were now [illegible] showing that the jug had [illegible] impurity to the water now in C. The [illegible] D was also thrown away, and the glass rubbed and polished with a so-called clean glass-cloth. On again filling D from the tap, and throwing in fragments of camphor there was no motion, the cloth having imparted a film to the water.

After these appalling revelations regarding the universal presence of dirt in apparently the cleanest of the vessels from which we eat and drink, it is with great satisfaction that we learn that some liquids (as ether and absolute alcohol) carry with them certain purifying influences of their own, and impart them to the water and the vessel; and strong wine (in consequence of the alcohol and wine-ether which it contains) thus possesses the property of making the wineglass into which it is poured chemically clean. If we take off about a third of the wine, the part of the glass between the original and the reduced levels remains completely wetted, and the phenomenon known as "weeping of the wine," or "tears in the cup," may be observed, which, as one author thinks, was referred to by the wisest of men when he wrote of the wine that "moveth itself aright" in the cup. The supply of liquid in the glass between the two levels is kept up for a considerable time by a twofold action, which Mr. Tomlinson describes as follows: In the spaces between the tears will be seen an ascending wavy current of liquid, which rises (1) by the adhesive action of capillarity (there being strong capillary action between the reduced level and the plane of liquid left in the glass), and (2) by the formation of a back current, in consequence of the downward flow of the tears, just as a back-water is formed at a place where two currents of a river meet; and this action in a glass of wine will be rendered more apparent if there are any specks or floating particles moving on the surface to show its direction.

In some cases, Mr. Tomlinson finds that tears are due to the evaporation and condensation of the liquid in the glass. This effect may be shown by filling a long tube with spirits of wine, and then nearly emptying it, so as to clean the surface. If the tube be now fixed vertically, and the flame of a spirit lamp applied below for a short time, tears will form at different heights.

Another phenomenon connected with a glass of wine is readily explained by the doctrine of chemically clean surfaces; but in this case we must take a sparkling wine, supersaturated with gas—champagne, for example. (Soda water will do, if champagne is not at hand.) If a sparkling wine or other fluid supersaturated with gas, "be poured into a chemically clean glass, no bubbles of gas will form on the sides, because the adhesion between the sides and the solution is perfect, and the sides may be regarded as a continuation of the liquid itself." If a clean glass rod is immersed in the glass of wine, no bubbles will form around it, for it merely acts as an additional portion of clean side would do. If, however, the rod be dirty, "there will be little or no adhesion between the water of the solution and the dirty surface; but there will be an adhesion between the gas of the solution and the unclean surface, and hence there will be a liberation of gas." Here we have the explanation of the well known fact, that by dropping a bit of bread into a glass of champagne that has ceased to effervesce, we excite a fresh evolution of gas. All bodies that have been exposed to the touch of what society would deem clean fingers, become chemically unclean, as has been shown by the camphor experiments which we have already described. They become covered with an organic film, and act as nuclei in liberating gas, like, and for the [illegible] as, the dirt on the unclean glass rod.

The importance of the presence of solid nuclei of some sort or other (even a speck of dust will suffice) in setting up the process of crystallization in saline solutions [illegible] with every manufacturer in school [illegible] this subject [illegible] was told the curious fact, that in crystallizing saline solutions on a large scale in chemical manufactories, the workmen stretch clean white strings across the large vessels into which the solution is to be poured; and they find practically that the strings act best as nuclei when they draw them through their hands, which, as he was informed, "*are not particularly clean*." How little do we think, in admiring a splendid case of gorgeously tinted crystals, that so magnificent a structure may have been started into existence by a pair of extra-dirty hands!

Mr. Tomlinson has shown us that we and all our surroundings are unclean; that our fingers, on whose cleanliness we relied, are so dirty as to defile the water they come in contact with, and our snow-white table linen is as "filthy rags." Has so great a philosopher no concluding words of consolation? He has told us of our impurities; cannot he also tell us how to become clean? Alas, no! If we were "flasks or other apparatus," which we don't suppose we are, although old Buchan, in his *Domestic Medicine*, tells us that "a young baby is a bundle of delicate pipes," our surfaces might be chemically cleansed by washing them "with strong sulphuric acid, or with a strong solution of caustic potash, and then rinsing with water." This, we are told, "is generally sufficient." Should any of our readers, over-enthusiastic in the cause of cleanliness, venture to try these appliances on their own surfaces, they would find them more than "sufficient." The sulphuric acid would convert the skin into a black charred mass, while the potash would be scarcely less destructive.

How the French Fatten their Poultry.

Any of our countrymen who, from rheumatic gout or any other ailment, may be sent to Vichy, would do well as soon as they have sufficiently recovered the use of their legs to pay a visit to the Villa Belvedere, where a very singular mode of fattening poultry has been for some time successfully pursued. A large circular building, admirably ventilated, and with the light partially excluded, is fitted up with circular cages, in tiers rotating on a central axis, and capable of being elevated, depressed, or rotated, which are so arranged that each bird has as it were, a separate stall, containing a perch. The birds are placed with their tails converging to a common center, while the head of each may be brought in front by a simple rotary movement of the central axis. Each bird is fastened to its cell by leathern fetters, which prevent movement, except of the head and wings, without occasioning pain. When the feeding time comes, the bird is enveloped in a woollen case, from which the head and neck alone appear, and which is popularly known as its "paletot," by which means all unnecessary struggling is avoided. The attendant (a young girl) seizes the head in her left hand, and gently presses the beak, in order to open it; then, with her right, she introduces into the gullet a tin tube about the size of a finger. This tube is united to a flexible pipe, which communicates with the dish in which the food has been placed, and from which the desired quantity is instantaneously injected into the stomach. The feeding process is so short that two hundred birds can be fed by one person in an hour. The food is a liquid paste, composed of Indian corn and barley mixed with milk. It is administered three times a day, in quantities varying according to the condition of each bird. The food seems to be very satisfactory, for if any chances to fall they devour it all as soon as they are released from their paletots. The poultry house is well ventilated; but, of course, it is impossible for any place where six hundred fowls are confined to be entirely free from smell. It takes about a fortnight to fatten a bird by this method. Before being killed the birds are left in a dark but well ventilated chamber for twenty-four hours without food. Each fowl is then taken up by its feet, is wrapped up so as to prevent all struggling, and then bled so adroitly in the throat that its death seems instantaneous. The blood is then allowed to flow from it, and finally, after being plucked, washed, and cleaned, it is wrapped in a damp cloth and is ready for sale. From forty to fifty fowls are thus killed and sold daily.

A Blake stone crusher now at work upon the new Capitol grounds at Albany, is said to be a success. It crushes large stones with ease into a size suitable to be used in making concrete for the foundation of the new Capitol.

Improved Device for Heating Feed Water for Boilers.

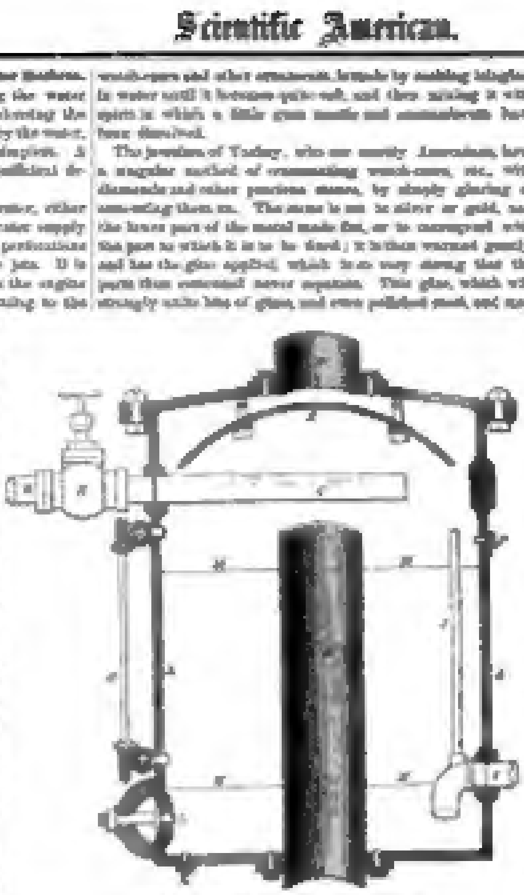
Among the many devices designed for heating the water before being thrown into the boiler, and for condensing the exhaust and depositing the salts held in solution by the water, the one herewith shown in section is among the simplest. A reference by letters to the engraving will be a sufficient description of the apparatus.

A is a cast iron or plate iron reservoir for the water, either circular or of any other form desired. B is the water supply pipe, perforated at C, on the top, through which perforations the water is forced by its head, or a pump, in fine jets. D is the pipe through which the exhaust steam from the engine enters. E is a concave plate, circular, or conforming to the form of the reservoir, against which the jets of water are thrown and from which they are deflected. F is the exhaust pipe for the escape of the surplus steam. G is the glass gage to denote the hight of water in the heater. H is the gate by which the supply of water through the pipe, B, is regulated. I is the pipe connecting with the pump. J is an air pipe connecting with the feed pipe, I, for arresting the flow of water to the boiler pump when reduced to the line, N, thereby preventing oil, tallow, or other floating substances from entering the boiler. K is a plug for carrying off sediment or for drawing off the water to prevent freezing. L is a handhole for cleaning; M, the highest point of water line; N, lowest point. O are bolts for detaching deflector, E, and P plug for overflow.

The exhaust steam from the engine enters through the pipe, D, and, coming in contact with the cold spray from the sprinkler, C, instantly heats it to the boiling point, or the temperature of the steam. A portion of the steam is condensed and forms part of the boiler water supply, while the surplus passes off around the edges of the deflector and escapes through the pipe, F. The other portions of the apparatus, with their operation, are readily understood by a reference to the engraving.

The patentees, having given it a fair trial under many varying circumstances, and in connection with boilers of various types, believe that it furnishes the boiler with a full and steady supply of thoroughly heated water, raised to 212 deg. by means of the exhaust, without producing any back pressure on the engine; that it prevents incrustation in the boiler by separating lime or other impurity from the water and retaining it in the heater, from which it can be readily removed through the handhole, L; saves fuel to the amount of from ten to twenty per cent by furnishing the water at a boiling heat or nearly so, relieving the engine of back pressure, and supplying water to the boiler pure and free from sediment, a bad conductor of heat; beneficial to the boiler for the reason above mentioned and because preventing unequal expansion of the iron by difference in the temperature of the water. It is evident that the objects, if attained, will serve also as a safeguard against explosions. Engineers and owners of boilers would do well to examine this heater.

Patented April 5, 1864, and Feb. 19, 1868. All communications should be addressed to the Waters' Patent Heater Co., 41 Trumbull st., Hartford, Conn., or to the office of the company, 118 Nassau st., N. Y. City. See advertisement on another page.



WATERS' FEED-WATER HEATER.

Improved Device for Tipping Carts.

The design of the simple device shown in the accompanying engraving as attached to a common cart, is to facilitate the tipping of a cart and the dumping of its load, being operated either at the front or rear by the simplest mechanism, not liable to get out of order and always at hand to perform its work.

A, in the engraving, is a catch lever pivoted at B to the front of the cart, having a spring, C, to hold it to its work, and terminating in a pawl or latch at D, that engages with a staple, g, secured to the cross bar or brace, A. To the lower end of the lever, A, is connected a rod passing under the cart and terminating at E, by which the catch may be worked by the driver when at the back of the cart.

Attached to the lever or catch in front, and just above the latch, D, is an L-shaped slide, or rather a slide forming three sides of a square that serves to keep the catch, D, disengaged from the staple, g, after the catch has been unlatched, and locks it when in contact with the staple, it sliding freely by its own weight, on the lever. This is not shown in the engraving. In operation the catch may be disengaged at the front by pressing upon the lower part of the lever catch, or by pulling the rod at the rear. The advantages of this device are apparent, and its simplicity is such that any country blacksmith can make, attach, or repair it readily.

Patented by Joseph H. C. Applegate, Dec. 29, 1868. Orders for state and county rights may be addressed as above, or to Garrison & Woodruff, P. O. Box 238, Bridgeton, N. J.

APPLEGATE'S PATENT CART CATCH.

Cements for Glass and Metals.

This article, so much esteemed for uniting pieces of broken glass, for repairing precious stones, and for cementing them to watch-cases and other ornaments, is made by soaking isinglass in water until it becomes quite soft, and then mixing it with spirit in which a little gum mastic and ammoniacum have been dissolved.

The jewelers of Turkey, who are mostly Armenians, have a singular method of ornamenting watch-cases, etc., with diamonds and other precious stones, by simply glueing or cementing them on. The stone is set in silver or gold, and the lower part of the metal made flat, or to correspond with the part to which it is to be fixed; it is then warmed gently, and has the glue applied, which is so very strong that the parts thus cemented never separate. This glue, which will strongly unite bits of glass, and even polished steel, and may be applied to a variety of useful purposes, is thus made in Turkey: Dissolve five or six bits of gum mastic, each of the size of a large pea, in as much spirits of wine as will suffice to render it liquid; and in another vessel, dissolve as much isinglass, previously a little softened in water (though none of the water must be used), in French brandy or good rum, as will make a two-ounce vial of very strong glue, adding two small bits of gum galbanum, or ammoniacum, which must be rubbed or ground till they are dissolved. Then mix the whole with a sufficient heat. Keep the glue in a vial closely stopped, and when it is to be used, set the vial in boiling water. Some persons have sold a composition under the name of Armenian cement, in England; but this composition is badly made; it is much too thin, and the quantity of mastic is much too small.

The following are good proportions: Isinglass soaked in water and dissolved in spirit, 2 oz. (thick); dissolve in this 10 grains of very pale gum ammoniacum (in tears), by rubbing them together; then add 6 large tears of gum mastic, dissolved in the least possible quantity of rectified spirit.

Isinglass dissolved in proof spirit, as above, 3 oz.; bottoms of mastic varnish (thick but clear), 1½ oz.; mix well.

When carefully made, this cement resists moisture, and dries colorless. As usually met with, it is only of very bad quality, but sold at exorbitant prices.—*Cooley's Receipts.*

A Civil Engineer on the Pacific Railroad writes that he has seen a remarkable curiosity—a natural hot spring—up in Nevada, which he describes as situated in a crater one hundred and fifty feet long in one direction and seventy-five in the other—a mammoth bath tub in shape. The depth of the water is unknown, no lines brought here having been long enough to reach the bottom. In one part the water is just hot enough to enable the hand to be held in it, and the remainder varies from this to lukewarmness. The walls are nearly vertical, and you can imagine the luxury of a plunge into it, with no fear of striking bottom. Just think, too, of swimming about on a cold November day, with the rising steam deposited in frost upon the walls, in water which is of a temperature perfectly luxurious. The water tastes slightly of sulphur, iron, and lime.

NOTES ON THE VELOCIPEDE.

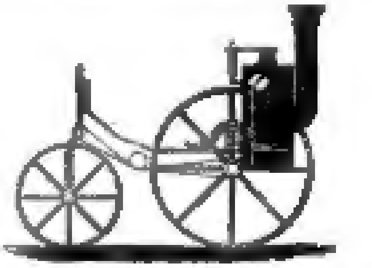
Thus far, the two-wheeled velocipedes maintain their ground steadily against all rivals. While allowing the as yet superior grace and speed of this style of machine, we still are compelled to believe that the velocipede, destined to become a fixed fact as much as locomotives and steamboats, is not yet born. Our inventors are striving hard to bring forth this ideal vehicle, and from the combined efforts they are putting forth, it will be strange if they do not at last hit upon it.

Our enterprising neighbor, the *Sun*, is, as Sam Weller would say, "rather severe" upon some of the new devices, it says:

"Before inventing a new velocipede, it would be advisable to become expert in riding those now in existence. Generally, our inventors have proceeded upon abstract principles, and have fallen into absurdities from which a little previous practical knowledge would have saved them. And yet, strange to say, we know of one instance in which practical knowledge led an inventor astray. He devised and built a velocipede on an entirely new principle. Theoretically he saw that it was a good thing; and he is a man of science as well as of sense, so that his theoretical opinion is of value. Having got it done, he tried to ride it, but failed. He could ride the ordinary machine very well, but that new-fangled apparatus was too much for him. In despair he took it to pieces, and never even sought a patent for it; and yet the same machine, invented and patented by another, is now regarded by experts as the most original and probably the most valuable contribution of the day to the new mode of locomotion. It is harder to learn than the ordinary machine; but though it is not yet fully tested, we anticipate for it a long and brilliant popularity among the votaries of velocipedestrian science. We hear also of one or two other novelties that are not without promise, and little additions to the comfort of riders are constantly made by manufacturers. One of the most valuable of these is the triangular movable pedal of Pickering, with which the feet can never be placed amiss upon the cranks. But, as we have said, most of the new contrivances are nonsense; though, as we have not examined those of Indiana, we still hope that so great a commonwealth may produce something of real and permanent worth."

Now, as our neighbor, in the above extract, acknowledges the possibility of mistakes, even by theoretical and practical men, is it not probable that many of the devices which now meet its disapprobation, may turn out to be just the thing after all? It criticises the one-wheeled velocipede, an English invention, an engraving of which we present below, as being liable to give its riders broken noses, but we might remind it of the feats of balancing performed on equally as unstable a basis as this contrivance appears. Would it be more difficult to keep upright upon such a wheel, than to sit in a chair balanced upon two legs, resting upon the rather uncertain substratum of a slack rope?

The engraving needs little explanation. The feet are placed on short stilts connected with the cranks, one on either side of the rim, while the rider sits upon a steel spring saddle near the center of the whole wheel. The inventor modestly limits the diameter of the wheel to twelve feet, and the number of revolutions at fifty per minute. Twenty-five miles per hour is the speed expected to be reached.



We also give an engraving of a steam velocipede. The cylinders and their attachments to the two driving wheels are not shown. They are placed vertically in front of the boiler, between it and the seat, and connect with cranks on the shaft of the driving wheels. The engraving shows the position of the boiler relatively to the other parts of the machine. The engine is a direct-acting compound engine of two cylinders, each cylinder 1½ inches diameter, and 3 inches stroke. The steering gear consists of an endless chain over a grooved wheel on the engine shaft, and passing over a corresponding wheel fixed between the forked shaft just over the front wheel. The

lower geared wheel is a wide one, and over it passes another chain. This latter chain works round the hub of the front wheel. This arrangement gives power to the front wheel, so that in turning a corner, this wheel takes a wider sweep than the two driving-wheels, which go first. In traveling on a straight road (backwards) the machine is turned to either side by turning the steering wheel to the opposite side. The boiler is a vertical one, with four tubes 1½in. internal diameter, hanging down by the side of the firebox. The fire-grate is cast with four holes in it to receive the bottom ends of the tubes, so as to help to hold them firmly. Hight of boiler, 28in.; hight of firebox, 15in.; diameter of firebox, 11in.; diameter of boiler, 14in. The firebox and tubes are copper, pressure 80lbs., but 5lbs. of steam will be equal to a velocipede propelled by the feet. Great speed is expected from this velocipede.

Our attention has been called to the fact that notices of infringement are being served by the proprietors of a patent granted by the United States, in 1866, to Pierre Lallement, Paris, France, assignor to himself and James Carroll, of New Haven, Conn., upon various velocipede manufacturers throughout the country.

We herewith give the claim of this inventor and an engraving of the velocipede, taken from the report of the Commissioner of Patents.

VELOCIPEDE.—Pierre Lallement, Paris, France, assignor to himself and James Carroll, New Haven, Conn.—Dated Nov. 20, 1866.—The fore-wheel is axled in the jaws of a depending bar, which is pivoted in the frame, and turned by a horizontal lever bar. This wheel is revolved by a crank-treadle.

Claim.—The combination and arrangement of the two wheels, A and B, provided with the treadles, F, and the guiding arms, D, so as to operate substantially as and for the purpose herein set forth.

The inventor of this velocipede being an alien, proof that a velocipede similarly constructed had been introduced into this country previous to the date of application would render the patent void.

Proof that the patentee had neglected to put and continue the invention on sale within eighteen months after the date of the patent would also render it null.

The above patent does not cover the idea of making two-wheeled velocipedes, nor of applying the propelling power directly to the front wheel, nor of pivoting the wheels. It remains to be seen whether the use of foot-cranks, which appears to be the novel point, can be sustained.

Two-wheeled velocipedes, having the front wheel pivoted in the frame, and guided by a horizontal bar, were in use forty years ago, of which we will give an engraving in our next. These vehicles had no foot cranks, but were propelled by the hands by means of a toothed lever acting on the front wheel, also by pressure of the rider's feet upon the ground; either method separately, or both combined could be employed in propulsion, and a very high speed attained.

It is by no means certain that the "coming" velocipede is to be a two-wheeled vehicle. What is very much needed is a velocipede which shall be light, graceful, easy to mount, and easy of propulsion—something, in short, which everybody, young or old, can use with satisfaction, and without the constant fear of capsizing.

We lately saw on Broadway a very successful four-wheeled velocipede; the wheels were about as high as an ordinary buggy, and the rider moved it about with the greatest ease and rapidity.

There is a very wide field for study and improvement of the velocipede. The demand is far greater than the ability of makers to supply.

So far as we can ascertain, the following is a correct list of the patents granted in the United States for velocipedes up to January 1, 1869:

Name.	Residence.	Date.	No.
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

The *Times*, of this city, has been taking a velocipede census, and announces that there are five thousand pupils in various stages of advancement in this city. The rooms of the numerous velocipede schools are open almost, like the restaurants, "at all hours," but still disappointed applicants for admission have to be turned away. The greatest difficulty is, however, to get the velocipedes, the demand being far ahead of the supply.

Philadelphia has recently produced a velocipede of an entirely new style. There are but two wheels, the seat sitting quite low between them. The novelty consists in a rag attached to the guiding-post, by means of which the rear wheel is made to follow directly in the track of the forward wheel. No matter how short the turn, both wheels make it at the same time, and the seat always remains parallel with the driving-wheel. In other machines there is no guide to the rear wheel, and consequently the machine cannot be turned so readily when a collision is threatened. The new machine, which is called the "Keystone," in honor of its native State, is substantially built, and so far as it has been tested in the riding school, is pronounced a success. How it will operate on the roads and in the parks, remains to be seen.

A correspondent of the *Reading Post* says:

"The velocipede fever continues to create excitement in Chicago. Two riding schools for instruction in the art of balancing upon these vehicles, have been established, and the machines are kept for sale at various places. Imperfectly levelled streets—many of them paved with wooden blocks—are admirably adapted to this species of propulsion, and several of the business men, living two or three miles from their offices, make their daily trips with two-wheeled vehicles, quickly leaving the [illegible] horse-car men in the distance. The demand for velocipedes greatly exceeds the supply, and the smaller cities around are taking the contagion and sending in their orders. The lucky manufacturers must be reaping a rich harvest, and ought to reduce the present extortionate price of $100 and $125, as they doubtless will have to do eventually. Meantime Chicago hails any invention of a *fast* nature, and the velocipede is likely to become a permanent institution there."

Seneca Falls, N. Y., claims to have produced the first velocipede. It was built in 1820 by David Hall and Jason Servill, and was an undoubted success. It was in existence so late as 1866, when it was destroyed by fire, together with the building in which it was kept.

New Bedford had a velocipede race for a silver cup recently. A large number were present and there was much excitement. The distance to be accomplished was a quarter mile, which was ten times around the rink.

The "velocipede mania" has also broken out in Boston.

Rev. Henry Ward Beecher, in a recent lecture on "Rational Amusements," made the following remarks:

"One of the great questions of the day was in relation to the "coming man" and how he was to come. He thought he was coming on a velocipede—a new machine that was bound to play a prominent part in the category of amusements—a toy to some, an instrument of pleasure and good use to others. He had purchased two for his own boys and there was every probability of him riding on one himself. He was not too old to learn, but he hoped it would not be said that the velocipede was his hobby. His auditors were not too old to learn, and he would not at all be surprised to see, in a short time hence, a thousand velocipedists wheeling their machines to Plymouth church."

A riding school for ladies has been opened in this city, on Fifth avenue corner of Fourteenth street, at what is known as the Somerville Art Gallery, which has two fine halls, each with an area of over 5,000 square feet. One of these halls will be set apart for beginners and the other for those more advanced. An exchange says:

"With a proper costume of their own sex, and with suitable dresses for the preliminary practice, ladies can obtain such a command over the velocipede in one week's practice of an hour daily, that they can ride side-saddle-wise with the utmost ease."

From the New York Sun.

HANS BREITMANN'S [illegible] ABOUT [illegible] PHILOSOPHERS.

[illegible]

CHAS. G. LELAND.

A MUSEUM OF THE ELEMENTS OF MACHINERY.

The Massachusetts Institute of Technology, having successfully organized its Society of Arts and its School of Applied Science, is now about to organize and establish the third department of the Institute, namely, a Museum of Arts. The Society of Arts has been in successful operation for six years; the School opened in 1865, has already twenty teachers and one hundred and seventy-five students, and is the largest scientific or technological school in the country. The creation of the Museum of Arts, contemplated from the beginning, is just now taken in hand. The whole scope and range of usefulness of such a Museum is by no means to be foreseen at its start. It must be developed gradually; and its best growth will not be favored by too rigid plans at the outset.

But in the mechanical department of the Museum, taking the term "mechanical" in its most comprehensive sense, a general plan of a certain novelty and of much interest to inventors, has already been adopted and promulgated by the Curator of the Museum, Mr. E. P. Ruggles, of Boston, a gentleman well-known to many of our readers as a successful inventor.

Mr. Ruggles and the Committee of the Institute upon the Museum do not propose to copy the costly collections of models of complete machines, which have elsewhere been made at such cost of time and money, and with such feeble results in facilitating new invention. Machines are incessantly superseded in whole or in part; the models of to-day are not the working patterns of to-morrow; most machines, if not in work, deteriorate rapidly. To keep a printing press in order requires the constant attention of a skillful workman. A model of a locomotive, or of a sea-going steamer, just finished, is next year only a bit of history. An inventor who wants to study the best machine in any department of industry, will not go to see it at a museum where it is not in operation; he will visit the shop, mill, or forge where the newest machine of the kind is most successfully working. Moreover, such collections soon outgrow all reasonable limits of space, and the proper care of them drains the deepest purse.

The Institute of Technology, therefore, proposes to make a collection of the elements of machinery, and the simple combinations of these elements. Machines consist of infinitely various combinations of simpler parts which repeat themselves in different proportions or modifications. Mr. Ruggles wishes to make a tangible encyclopedia of these elements of machinery. He proposes to collect and make working models of all the elements, of all the varieties of reciprocating motions, for example, of all the devices for converting a reciprocating into a rotatory motion, or a rotatory into a reciprocating, of all the varieties of cam motions, of quick and slow screws, so combined as to give both speed and power, of eccentric gear combinations, of reversing movements, of compression for pressing by means of screws, toggle-joints, cams, and levers, of the different escapement arrangements for watches and clocks, of universal joints like the gimbal and ball and socket joints, and of all other primary mechanical devices by which force and motion are transmitted, directed, or modified. These models are to be classified by subject, catalogued with precision, and placed in cabinets in the order of subjects.

The singular advantages of this plan for a Museum of Machinery are apparent at a glance. In the first place, it would be of manageable bulk. Secondly, it would never grow old. The elements of machinery are worked over and over again into new machines, just as the words of a language are constantly run into new sentences. The writers change; style and usage are insensibly modified from generation to generation; but the roots of the language remain for centuries. Thirdly, such a collection can always be added to with ease; as is the case with a card catalogue in a great library, additions, from time to time, as new inventions of elements were made, would make it more comprehensive without rendering the older material less accessible or less useful. Lastly, a collection of models of the elementary parts of machines would be more profitable for study than a collection of models or pictures of complete machines. The simpler should go before the more complex. The real object is far more intelligible than a drawing or a description. The students of the school, inventors, and the public generally would get more genuine instruction from such an analytical museum than from a much larger and more costly collection of actual machinery. A machine can rarely be fully seen and comprehended by persons not experts without being taken apart; in very many machines the really peculiar and significant parts are covered with less instructive appendages; the characteristic idea is hidden under a mass of commonplace [illegible]. Yet it is the characteristic invention in each machine which is its most instructive portion.

The proposed classification of models of the elements of machinery would be of especial service to inventors. A mechanical invention consists generally in a new combination of mechanical elements, so as to produce a machine having some new capacity or function; but the inventor is too often unacquainted with the known elements and simple combinations of machinery. No collection contains them in an accessible form; no catalogue or index directs him to the movements which he needs in his new design. The elements of machinery are not in every day use among all people like the elements of language in common speech and familiar writings, but are hidden away in the machinery of scattered shops and factories. The inventor too often has to re-invent, at great expense of thought and money, elements or combinations which have long been in use, but which he has never seen. Even then he may not devise so good methods of producing the desired effects as have been previously invented and are at his disposition if he only knew of them. The work of the inventor, like that of the author, is emphatically

brain-work. But inventors have no such aids in their labor as literary men have. The proposed museum, with its catalogues and indexes would aid inventors somewhat as libraries, dictionaries, and gazetteers help authors. An inventor, meditating upon his design, sees that he has need of some peculiar movement; but he knows no means of producing that movement. He consults Mr. Ruggles' classified collection of elementary movements, and sees at once among the various screw movements, for example, that a combination of quick and slow screws is capable of producing the particular movement which he has need of. He is thus saved the labor of inventing for his purpose. This is not an imaginary problem, but one which often actually occurs. Many simple and familiar contrivances are constantly re-invented. Examples will occur to all inventors. Who can tell how often the Archimedean screw has been discovered? Even the cam is constantly invented anew. Inventors have hitherto been too much left to their own unaided mental resources. Dictionaries and glossaries do not replace genius, nor make one talent go as far as ten; but they are important aids to genius, and they enable common men to do much accurate and useful work. So the collection of elementary models, which Mr. Ruggles proposes to bring together, will not diminish the field for inventive genius; but it will instruct inventors as a class in what has already been done, and it may be expected to prevent in some measure the waste of time and strength involved in re-invention.

People believe in a vague way that inventors are an important class in the community; but few fully realize the importance of lending them every possible aid in their civilizing work. The American community is made possible by American and foreign invention. The crops of the West could neither be harvested nor brought to their distant markets without the mechanical reapers, rakes, threshers, hullers, elevators, and cheap railways by which they are handled. The American dwelling-house is full of devices, great and small, to promote the comfort or luxury of its inmates. Education and liberty owe much to the inventors of power printing-presses. By the telegraph, the railways, and the swift steamers, this continental republic is made practically smaller than little England was fifty years ago. One man, with the aid of coal and the mechanical appliances which inventors have created, can do more work, or produce more wealth in a day than a thousand could without these aids.

The Massachusetts Institute of Technology is therefore undertaking an important work in establishing this Museum of Arts. It appeals with confidence to inventors and constructors of machinery for working drawings, not of entire machines, but of the *characteristic parts* of their inventions or constructions; and it asks all men who are interested in promoting the progress of the mechanic arts for such aid, in money or influence, as they can give.

Inventors, constructors, and all persons interested, are earnestly requested to contribute to this Museum detailed drawings of the peculiar elementary features of such inventions as are within their knowledge, accompanied by the necessary descriptions. *If working drawings cannot be furnished, sketches with full descriptions will be available substitutes.*

THE HADROSAURUS ON THE STAGE.

From the New York Evening Post.

At the lecture of Professor Waterhouse Hawkins, before the American Institute, on the evening of January 27th, the audience were taken completely by surprise by the unveiling of the restored skeleton of a huge reptile called the "Hadrosaurus." The restored monster, supported by strong iron braces, was fourteen feet eight inches high, entire length along the back twenty-five feet, and length of tail alone, twelve feet. He had been skillfully concealed behind curtains, which, covered with diagrams, left no suspicion of anything behind them. At the proper moment, the curtains were dropped and the animal stood out in full view.

The Hadrosaurus was described and named by Joseph Leidy, of Philadelphia, who gives the following account of its discovery:

"Attention was first called to the discovery of the remains of the Hadrosaurus in the autumn of 1858, by W. Parker Foulke, of Philadelphia, member of the Academy of Natural Sciences, a gentleman who has always displayed a great interest in the advancement of the objects of the latter institution. While passing the season at Haddonfield, Camden county, New Jersey, Mr. Foulke learned from one of his neighbors, John E. Hopkins, that in digging marl upon his farm twenty years back, there had been found a number of large bones. These were said to have consisted mainly of vertebræ, and had been gradually distributed among visitors who were curious in such objects, so that none remained in the possession of Mr. Hopkins. In the hope of finding additional portions of the skeleton, with the permission of the latter gentleman, Mr. Foulke employed men to search in the place of the old excavation. This was situated in a narrow ravine, through which a brook flowed eastwardly into the south branch of Cooper's Creek. At the depth of nine feet from the surface the men were successful in finding numerous bones. These were imbedded in a stratum of tenacious bluish black micaceous clay, in association with a multitude of shells, an echinoderm, several small teeth and vertebræ of fishes, coprolites, and some fossilized coniferous wood.

After a careful examination of the osseous remains, Leidy came to the conclusion that the Hadrosaurus Foulkii was a reptile of huge proportions, and of the same habits of life as the great Iguanodon of the wealden and cretaceous deposits of Europe. A study of the teeth showed it to be a vegetable feeding reptile, one which masticated its food like the herbivorous mammalia.

The few scattered bones of the fossil were preserved in the Museum of Natural History in Philadelphia, and after careful measurements during the past summer, a labor requiring nearly six months of the closest study, Mr. Hawkins has been able to restore the animal in the exact size and proportions of life. It is doubtful whether any other living man could have accomplished this remarkable feat, but Mr. Hawkins brings to bear the experience acquired in the restoration of thirty-six extinct animals for the gardens of the Crystal Palace at Sydenham, and we can place entire confidence in the accuracy of the work. The Commissioners of the Central Park propose to erect a grand geological saloon, in which are to be placed the restored figures of the animals found in our own country. Upon the walls of the saloon, or building, will be drawn paintings illustrating the vegetation of the period during which the animals lived, and along the sides will be placed the actual geological specimens and fossil remains found with the skeleton.

A stuffed specimen of the nearest living representative of the genus will also be preserved in the museum of the Park. The Commissioners are worthy of the highest praise for the conception of a plan so fraught with instruction and amusement to the citizens of New York, and they are to be congratulated upon having secured the services of an artist, naturalist, and mechanic, so capable as Mr. Hawkins of carrying their wishes into execution.

The other animals to be restored are two specimens of Laelaps and the *Elasmosaurus platyurus*—all of them very comfortable to look at in a defunct state, but very inconvenient to have about if clothed in flesh and blood. We hope that the work, when completed, will give such an impulse to the study of geology and the natural sciences in our city as to arouse our citizens to a consciousness of the fact that there is no public museum of any sort in New York in which studies of this kind can be carried on, and that whoever now wishes for information upon such subjects is obliged to seek for it in Boston or Philadelphia. When our citizens fairly comprehend the disgrace of such a condition of scientific destitution, we may hope for steps to be taken to remove it, and the labors of the Central Park Commissioners will greatly aid the good work.

Mr. Hawkins' style of lecturing, combined with his graphic illustrations on the blackboard, added very greatly to the interest of the occasion. Without interrupting the flow of ideas, and while explaining the unity of plan in creation, and the economy of reptiles, he would, with a few strokes of his pencil, make each bone and joint grow under his hand, simultaneously with the description, so that when the story was ended the restored animal was completely delineated upon the canvas. The marvelous skill with the crayon, combined with the profound scientific knowledge of the lecturer, fixed the attention of the audience and frequently elicited spontaneous bursts of applause. The lecture was full of valuable information, and was one of the most interesting of the course.

The appearance of the Hadrosaurus upon a New York stage must be pronounced a great success, and we congratulate our neighbors of New Jersey upon being well out of such specimens of natural history.

Curiosities of Minute Mechanism.

Sometime ago, there dwelt not far from Lambeth Palace, in London, an ingenious mechanic named Thomas Smith, since dead, who devoted a large portion of his valuable life to the production of machines and models of almost microscopic dimensions. A writer in the *Gentleman's Magazine* visited Smith's workshop and furnishes the following interesting account of what he saw:

Beginning with the largest of his productions, the first object to which he directs our attention is a small steam-pumping engine for working a table fountain. All the adjuncts that pertain to a great pumping engine are to be found in this diminutive model. There was even the gage glass on the front of the boiler, as slender as a good sized needle, and fitted with taps at each end, in the orifice of which a pin could hardly be inserted. The whole thing worked to perfection, without emitting or any escape of steam from the engine or water from the pumps, and will throw a small jet of water in a distant part of the room to a height of twelve feet. The majority of working models of small dimensions are usually clumsy affairs, whose parts are made more according to the convenience of the workman than with reference to the work they have to do, and the strength that is expected in them; but to the credit of our micro-mechanic, be it said, that he scorns this style of thumb-style business. Some of his screws are not more than the eighteenth part of an inch thick, and these are furnished with hexagon-headed heads, and were perfectly shaped. Mr. Smith's powers enable an inventor to exhibit to his patrons the real working machine on a small scale.

At the time of our visit a number of diminutive garden pumps, small enough to be carried in the waistcoat pocket, are scattered over the work bench in various stages of completion. These are for the use of agents and commercial travellers trading with such articles. But the above-described curiosities are large compared with those next set before us. We are introduced to a model of the famous Great Britain, made to a scale of 1-48th of an inch to the foot, so that the length of the model is about eight inches, and breadth about 1½ inch. It is full-rigged, with its masts and their accompanying spars, and all the belaying-pins and deck fittings. The deck of this tiny vessel is lifted off and a magnifier is handed to us; this resolves a little heap of metal scraps into an accurate model of the original engines with which the Great Britain was fitted. So small is this model that it stands upon less space than the area of a shilling. The idea of such a model working seems preposterous, and we hesitate about asking whether it does or not. We are not long left in doubt. An annular trough of water is produced, and the ship is launched into the watery circuit. A tap is turned, and compressed air rushes through a tube and off goes the tiny ship to circumnavigate its little sea. There is no illusion, no trickery in this exhibition, the diminutive engines as really and truly work and drive the boat as do those of any steamer on the seas. The total weight of the boat, with deck and rigging, engines, boiler, and all entire, is less than a troy ounce! The actual weight of the working part of the engines—that is all excepting the boiler—is just that of a sovereign.

Having examined some other "practical models," one of which, the writer says, was "contained in a small pill-box," he proceeds to give "a few details concerning the microscopic edition of the Warrior's engines. "This tiniest working model in the world is now in the possession of John Penn (of Greenwich), the eminent maker of the great engines of which it is the infinitely reduced counterpart. It will stand on a threepenny-piece; it really covers less space, for its base-plate measures only 3-8th of an inch by about 3-16th. The engines are of the trunk form introduced by Penn; the cylinders measure 1-8th of an inch diameter, and the trunk 1-16th. The length of stroke is 3-32th of an inch. They are fitted with reversing gear, and are generally similar in design to the great machines with which ships of the Warrior class are equipped. From the extreme smallness of this model a few minutiæ—such, for instance, as the air pumps—have necessarily been omitted; there is a limit beyond which human skill and microscopic support pass. Still, so small are some of the parts that they require a powerful magnifying glass to see their form. The screws which hold the members together are only 1-400th of an inch diameter, and these are all duly furnished with hexagonal nuts, which can be loosened and tightened by a Lilliputian spanner. The whole weight of the model is less than a threepenny-piece. It works admirably, and when working its crankshaft performs from twenty to thirty thousand revolutions in a minute. It was made at a time when Mr. Smith, who suffers from a trying disease, was unable to move from a sitting posture; and the time spent upon it is reckoned at about three months ordinary labor. For such works as the above what must the tools be? We are shown drills and files of his own manufacture; and wonder at how any but a fairy's hand can wield them. The digits of our micro-mechanic are fat and large, as those of a workman usually are. We have heard a dancer described as a being with brains in his toes. Mr. Smith albeit has plenty of brains in his head, and must have, in addition, a very large proportion in his finger ends."

New Rooms for the Interior Department.

Mr. Fessenden, from the Committee on Public Buildings and Grounds, reported to the Senate a joint resolution authorizing the Secretary of the Interior to so change and alter that part of the Interior Department building known as the north wing thereof, as the floor occupied for the storage and exhibition of patent models, as to convert the same into rooms for use of the officers and clerks of the said Department; and appropriates $50,000 for such purpose, to be expended under the direction of the Secretary and the Architect of the Capitol extension, upon plans and estimates to be furnished by said architect and approved by the said Secretary. The second section authorizes the Secretary of the Interior to lease for a period not exceeding one year, with the privilege of continuing the same from year to year for five years, at a yearly rent not exceeding $10,000, the fireproof building on G street, for the use of the Department of the Interior, and appropriates $10,000 for that purpose. Section third authorizes the Secretary of the Interior to remove from the floor of the said Department building now occupied for the storage and exhibition of models, whenever, in his judgment, the accumulation of such models may render the same expedient, all such models as relate to applications of patents not granted, and all such as may be or may have been in said Department for a longer period than seventeen years; and to store such as may be deemed worth preserving in such parts of said Department building as may not be wanted for other purposes, and to dispose of the residue as he may think best, by sale or otherwise.

Enameling of Iron Vessels.

The enameling of saucepans and other articles in wrought or cast iron has long been practiced, a very fusible enamel reduced to powder being sprinkled over the surface of the iron when heated to redness; but as the mixtures employed consist of highly alkaline silicates, the enamel is not very durable, and will not withstand acids or even salt liquids. An improved process has been introduced in France. The metallic surface is brought in contact with the ingredients of ordinary white glass, and heated to vitrification; the iron is said to oxidize by combination with silicic acid, and the glass then forms one compact body with the metal. The coating of enamel may be laid on as thinly or as thickly as desired, but a thin coating is better as regards the effect of expansion or dilatation. Experiments are being made in coating the armor plates for ships in the manner above indicated.

◆

At the recent meeting of the Royal Dublin Society, in Ireland, the subject of introducing beet root sugar manufacture in Ireland was discussed in a very able paper read by Sir Robert Kane. He showed that it could be raised there in such quantities as to supply Great Britain and other countries with sugar. With the great advantages that Ireland possessed for the growth of root crops, he had been assured by many leading agriculturists that the prices paid on the Continent would be remunerative in that country, the soil and climate being preeminently favorable.

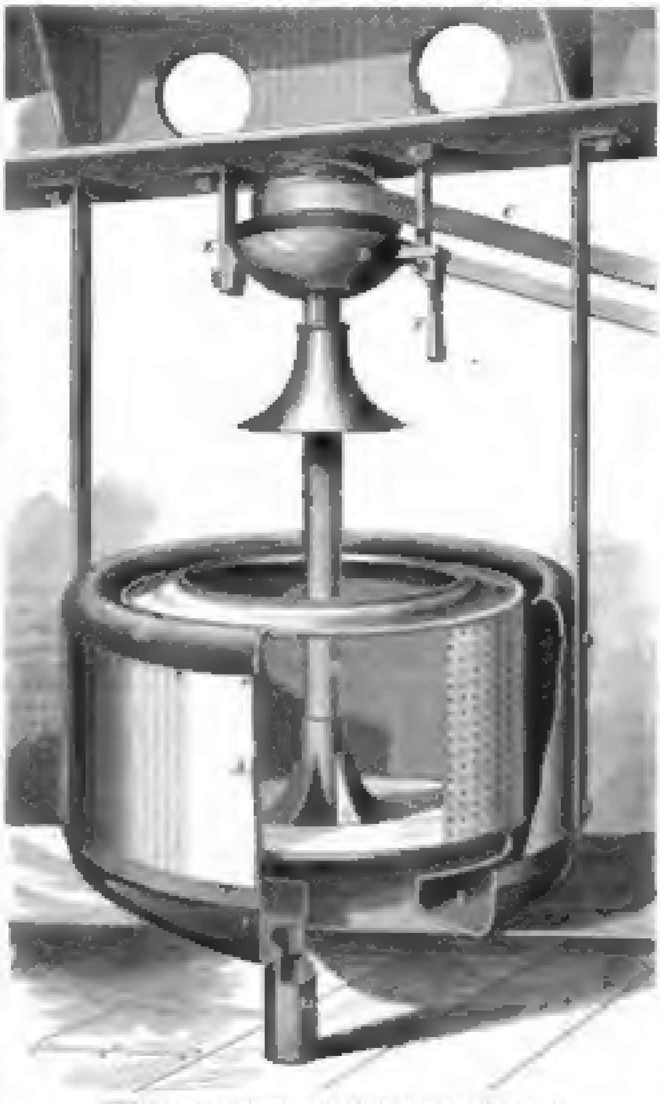
Improvement in Centrifugal Machines.

On page 9, No. 1, of Vol. XIX, SCIENTIFIC AMERICAN, we made some comments in regard to centrifugal machines designed for separating the molasses or sirup from sugar, and for other purposes, and gave some facts showing the advantages of Weston's improved machine over those in common use. These machines are used not only for draining sugar, but for drying clothes in laundries, for drying wool after being washed and colored, for bleaching, extracting tannin from spent bark, and for many other similar purposes, and are known as "Hydro-Extractors." The published article to which we refer gives a very good idea of the machine and its advantages. The accompanying engraving gives a view of Weston's improved machine.

Inside the suspended case, A, is hung a cylinder composed outwardly of sheet cast steel, perforated, as seen, and inwardly of brass-wire gauze. This cylinder is suspended by the spindle, B, which is hollow and receives an interior fixed spindle around which it revolves. The fixed spindle has a bearing near its lower end consisting of a series of convex washers of hardened steel filling the area of the inside diameter of the revolving hollow spindle, and diminishing friction by its distribution through their number. At its top this spindle is headed, the head bearing on a sleeve of india rubber held in an iron socket or bracket. This gives a chance for vibration of the cylinder in its revolutions. A pulley at the top of the spindle driven by a belt, C, gives rapid motion directly to the cylinder, and under it, and revolving with it, is a bowl-shaped casting turning inside a similar bowl, D, that is lined with wood or leather and fixed to a stud, E. At the opposite side is a strap working on a hand lever, F, by which the dishing piece, D, may be brought in contact with that inside it, operating as a brake to stop the machine when a charge is to be removed. This removal is effected simply by dumping the sugar through openings in the center of the cylinder, which, when the machine is in operation, are covered by the cone, G, seen in the engraving raised and held by a spring catch. The outer case, A, is suspended by bars bolted either to beams or iron girders overhead. As the molasses or sirup is thrown off from the sugar, it is forced by centrifugal motion through the interstices of the net or gauze, and the holes in the steel casing, and discharged through the spout, H, to which the inclined bottom, I, of the shell leads.

The elasticity of the rubber allows a certain amount of gyration to the suspended cylinder due to the unequal distribution of the load when the machine first starts. This gyration or eccentric motion soon ceases, and the machine finds its own center, and runs without jar. The friction, inseparable from the old style of machine, is greatly reduced, and also the amount of power necessary to drive it.

This improvement was patented by D. M. Weston, and the machines are manufactured by Merrick & Sons, 430 Washington avenue, Philadelphia, Pa., to whom, or to their agent, George Birkbeck, 88 Broadway, New York, all orders should be addressed.



WESTON'S PATENT IMPROVED CENTRIFUGAL.

◆

Manufacture of the French Atlantic Cable.

The manufacture of the telegraphic cable, which it is proposed to submerge between France and America next summer, proceeds with satisfactory rapidity. The cable is to start from the French coast at or near Brest, and to be laid across the Atlantic to the French island of St. Pierre, off the American continent, a distance of 2,585 miles. Communication with the main land will be effected by means of an additional line, which will be laid from the island to probably some point in the State of New York. This will represent a further distance of about 752 miles, so that the whole length of two sections of the system will be about 3,337 nautical miles. These figures, however, only indicate the length in miles as it would be calculated without reference to submergence. A certain amount of slack cable will be necessary for the process of "paying out," and also a provision against such an accident as that which caused the failure of the Cuba and Florida expedition. With the addition of slack line, then, the deep-sea cable—the longer section—will be about 2,799 miles, including 143 miles for shore ends, and the auxiliary line, 775 miles, so that, altogether, a total length of 3,564 nautical miles of line will be manufactured for the purpose of the proposed expedition. The construction of the deep-sea cable will be similar to that of the Atlantic lines already submerged. The insulated core is strengthened with "a serving" of tanned jute, and is protected with ten galvanized homogeneous iron wires, served helically round the core, each iron wire being first strengthened with strands of Manilla hemp saturated with tar. The shore ends attached to the deep-sea cable will be of different weights, an intermediate section near the main line weighing about six tons, and the heavy end of the shore about twenty tons. The heavy shore end will be of great strength, as it will have an ordinary sheathing served with hemp, and another with stranded wires, coverings of hemp and asphalt forming an additional protection. An ordinary wire sheathing of ten galvanized iron wires will be used in the construction of the section which will connect the island of St. Pierre with the continent of America. This covering will be also protected with coverings of hemp and asphalt. In the construction of the cable the greatest care is observed that all the materials employed in its manufacture be of unquestionable excellence. The copper wire received at the gutta-percha works, where the insulated core is being made, is first tested that its quality and conductivity may be ascertained. When it has passed the necessary tests, it is forthwith prepared for forming the conductor, which consists of a strand of seven wires. In this part of the manufacture, the center wire is passed through a bath containing a mixture of tar and gutta-percha, known as "Chatterton's compound," before it receives any of the remaining six wires, which are subsequently woven round it—the object of this process being to prevent water penetrating through the strands of the conductor. The stranded conductor then receives alternate coats of Chatterton's compound and gutta-percha until it assumes the required consistence. The core for the deep-sea cable is to be of the following weight: conductor, 400 pounds; insulation, 400 pounds; total, 800 pounds per mile; for the shallower section, conductor, 107 pounds; insulation, 150 pounds; total, 257 pounds per mile. It may be incidentally remarked that the insulated core is larger than that of any other cable hitherto manufactured, if the old Malta and Alexandria line be alone excepted. When the core has been insulated it is kept for twenty-four hours in water at a temperature of 75 deg. Fah., and is then subjected to a series of electrical tests. Having passed this examination, it is wound round drums and forwarded to the works, where the final sheathing is put on, and it is then coiled away in tanks until its removal to the ship from which it is to be "paid out." Most favorable reports of the progress of the manufacture have, we understand, been given by the electricians who have tested the portion of the cable already constructed. Joints in the core have frequently presented serious difficulties to engineers and others engaged in the extension of submarine telegraphy; in the case of the new line it is probable that these difficulties will be almost entirely obviated, for, of 230 joints examined, only one has been found in any degree defective. About 600 miles of the deep-sea cable have been already manufactured, at the rate of about eighty-five miles a week. The *Great Eastern* is being fitted up with tanks for the reception of the cable. There will be three in number, of which the largest will be 75 feet in diameter and 16½ feet high. The cable will be conveyed to the "big ship" in hulks filled with water-tight tanks.—*New York Tribune.*

◆

Proposed Tunnel Under Dover Straits.

The project of tunneling a passage from England to France is still discussed in England, and plans have been submitted to the Emperor Napoleon for his approval. Probably the success with which the Mont Cenis tunnel has been worked through the solid backbone of the Alps has attracted new attention to a scheme which, on the face of it, seems far from being impracticable. It must be remembered, however, that the difficulties to be encountered in tunneling beneath the Straits of Dover are of a totally different character from those which the French engineers have had to meet with in tunneling through the Alps. The soil to be traversed in the former instance would probably be the "second chalk formation," which may be assumed to extend in an unbroken course from the place of its uprising in England to the place in which it makes its appearance in France. It need hardly be said that the difficulty of perforating this soil would be very much less than of perforating the hard and complicated material which has been encountered by the French engineers. On the other hand, however, there are dangers and difficulties in tunneling under the Straits which more than make up for the comparative ease with which the mere process of perforation would be pursued. It needs but a slight acquaintance with the history of the construction of the Thames tunnel to enable one to recognize the fact that the workers in the suggested tunnel beneath the Straits would be exposed to enormous risks from the effect of the pressure of the sea upon the stratum through which they would have to work. Again and again the water burst into the Thames tunnel, and drove the workmen out. Brunel himself nearly lost his life during one of these irruptions. Now if this happened beneath the Thames, what might be looked for from the effects of the enormous pressure of sea—to say nothing of the increased danger during heavy storms? And then the workmen in the Thames tunnel had but a comparatively short distance to run, when they were threatened with an irruption of water. If such an event threatened workmen engaged nine or ten miles from either outlet of the suggested tunnel, escape would be hopeless. In a short time the whole length of the tunnel would be filled with the waters of the sea, and the labors of years would be rendered useless.

We urge these considerations, however, not as deprecating the suggested attempt. Doubtless the dangers which we have pointed out may be encountered by a judicious choice of the stratum to be worked through and by cautious progress—defences being continually prepared around every fresh portion tunneled. The experience gained during the tunneling of the Thames shows that much can be done in that way; and we also have every reason to believe that once a tunnel was constructed it would be as safe as the Thames tunnel now is. There are difficulties in the way of ventilation, but such difficulties as these have to be dealt with (and have been most successfully dealt with) in the construction of the Mont Cenis tunnel. Three eminent engineers, Messrs. Hawkshaw, Brunlees, and Lowe, have pronounced the plan to be feasible; and the estimated cost—nine millions sterling—though large, is still reasonable when the value of the tunnel is considered.

Certainly the idea is at once a bold and an attractive one. Nature's barriers are being, one after another, overcome. Now a mountain is tunneled, then an isthmus is cut through, next the Falls of Niagara are spanned by a railway bridge. Hitherto, however, sea straits have not been successfully attacked, except where—as in the case of the Menai Straits—they are of very moderate extent. When voyagers can pass to France without encountering the terrors of seasickness, a veritable triumph will have been achieved over nature.

◆

Bleaching Wood Pulp.

A process of bleaching wood pulp has been made known by M. Orioli. He has recognized that chloride of lime however little in excess, has a tendency to produce a yellow tint; that all the strong acids turn the paste red under the action of the sun, or in some time without sunlight, in the presence of moisture; that the slightest trace of iron is sufficient to blacken the paste in a very short time. These objectionable results are obviated by the following mixture: For 100 kilogrammes of wood pulp 500 grammes of oxalic are employed, this serving the double purpose of bleaching the coloring matter already oxidized and of neutralizing the alkaline principles favorable to oxidation; 2 kilogrammes of sulphate of alumina, perfectly free from iron, are added. The principal agent in this new process is the oxalic acid, the energetic action of which on vegetable matters is well known. The sulphate of alumina added does not bleach of itself, but it forms with the coloring matter of the wood a nearly colorless lake, which enables the brilliancy of the product to be heightened.

Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN, S. H. WALES, A. E. BEACH.

☞ "The American News Company," Agents, 121 Nassau street, New York.
☞ "The New York News Company," 8 Spruce street.
☞ A. Asher & Co., 20 Unter den Linden, Berlin, are Agents for the German States.
☞ Tubner & Co., 60 Paternoster Row, London, are also Agents to receive subscriptions.
☞ Messrs. Sampson, Low, Son & Marston, Booksellers, Crown Building, 188 Fleet street, London, are the Agents to receive European subscriptions or advertisements for the SCIENTIFIC AMERICAN. Orders sent to them will be promptly attended to.

VOL. XX., No. 7 . . . [New Series.] . . . . *Twenty-fourth Year.*

NEW YORK, SATURDAY, FEBRUARY 13, 1869.

Contents:

(Illustrated articles are marked with an asterisk.)

*Improvement in Steam Generators
Manufacture of Bronze Powders
The Latest Novelty in Electricity—Wonderful Achievement of the Electrical Fluid
[illegible]
Removing Foul Air from Wells
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
How the French Pattern their Plates
*Improved Device for Moving Feed Water for Boilers
*Device for Tinning Cards
[illegible]
[illegible]
A Measure of the Dimensions of Molecules
The Mechanician on the Stage
[illegible]
[illegible]
[illegible]
[illegible]
Improvements in Centrifugal Machines
Manufacture of the French Admiralty
Proposed Tunnel Under the Bosphorus
[illegible]
Is Our Patent System Defective?
Can Heat Exist as Heat, and at the same time Perform Work?
What is an Axiom?
[illegible]
[illegible]
London Underground Railway
[illegible]
[illegible]
[illegible]
Manufacturing, Mining, and Railroad Items
Answers to Correspondents
Recent American and Foreign Patents
Inventions Patented in England by Americans
List of Patents

IS OUR PATENT SYSTEM DEFECTIVE?

The American patent system, recognizing as it does the rightful claims of the first inventor, has challenged universal admiration. Since its reorganization in 1836, it has acted as a great stimulator of the latent inventive power of our people, and the influence of this system has been felt in all the departments of art and industry. No other nation has witnessed the same degree of rapid material development, and no other people have more signally experienced the benefits of a just and generous protection of the claims of inventors.

Commissioner Foote, in his valuable report published in our last number, in speaking of the rapid advance of improvement, says: "New fields for exploration have been constantly opening, and so far from reaching any limit of invention, we soon find on the way to other advances and improvements beyond our present comprehension," a statement which is undoubtedly true, and forces the Commissioner to declare that the business of the Patent Office has outgrown the several acts creating it. He urges upon Congress the necessity of several much needed reforms to enable the office to meet the requirements of its rapidly augmenting business. In alluding to the prosperity of the Patent Office, the Commissioner qualifies his statements by the declaration, that much of the apparent prosperity has arisen from the allowance of patents that ought never to have been granted, and proceeds to give his reasons for such imperfection, which doubtless have more or less contributed to bring about the evils of which he complains.

It appears to us that the time has come when our patent system should be made the subject of a careful investigation with the view to determine what reforms are necessary, and more especially to inquire whether the present practice of examining applications is not productive of more evil than good, and whether we may not safely adopt the systems now prevailing in England, France, and other European nations, which allow patents to issue without previous examination. Commissioner Foote says worthless patents are now issued in large numbers, thus virtually acknowledging the failure of the attempt to carry out a rigid system of examination, a complication which is growing more and more serious every day.

Patentees do not thoroughly understand this matter; they take it too much for granted that, when their patents are issued—especially after a supposed careful examination by an expert, the validity thereof is fully established, and therefore they can confront all infringers with the perfect assurance that the patent will be sustained, some going even so far as to believe that Government is bound to warrant and defend the patent. The official machinery of examination, as at present organized, is cumbrous and expensive, and as results show, is far from being satisfactory; beside the present system tends to corrupt practices, especially when practitioners before the office make their professional services contingent upon success. *Shall this system be continued?* This subject is one of so much importance that we urge Congress to institute a searching inquiry into the whole question.

Inventors have a right to demand all the safeguards which law can provide to protect their patented interests, but in view of what Commissioner Foote asserts, it appears to be mockery and injustice to compel them to pay for an examination which often amounts to nothing. They would infinitely prefer to rely upon an experienced attorney, who is competent to make the investigation and to prepare such claims as in his judgment will stand the test of law.

CAN HEAT EXIST AS HEAT, AND AT THE SAME TIME PERFORM WORK?

A correspondent asks the question, "Can heat exist as heat at the same time it performs work?" In other words, "Can I use the same heat that drives my steam engine for warming the building in which it stands? I do not mean now the surplus heat which passes out of the smoke pipe, nor that radiated from the boiler, cylinder, etc., but the heat which is in the steam that drives the engine and the machinery. I wish to know what becomes of this heat after the work is performed." Another correspondent asks us "What becomes of the light in a room when all the apertures, windows, and doors are suddenly closed?"

These questions are so similar in their nature that we propose to answer them in a single article. They are not by any means frivolous. On the contrary, they are questions which have puzzled the wisest philosophers of past ages. "What becomes of force after it has performed work?" was the general form of the inquiry, the answer to which was long and earnestly sought by a host of the most philosophical minds the world has ever produced.

It is unnecessary to review here the different opinions which have obtained in regard to the imponderable agents, heat, light, electricity, etc., first regarded as *imponderable forms of matter*, next as occult forces, known only by their effects; and lastly, as *modes of molecular motion*. Suffice it to say that the latter theory has been sufficiently demonstrated by the labors of Rumford, Joule, Mayer, Helmholtz, Faraday, Grove, Tyndall, and others, to be generally accepted as truth by the entire scientific world.

Further investigations have established the fact that any of these motions disappear only to reappear immediately in some other form of motion. Thus, at the moment heat-motion disappears, some other motion or motions begin, exactly equivalent to the heat motion which has disappeared. This indisputable fact has led to the doctrines of the correlation and the *conservation of force*; the latter of which was asserted by Prof. Faraday to be the "*the highest law in physical science which our faculties permit us to perceive.*"

We start then in answering the above inquiries from the broad basis, that nothing can be added to or subtracted from the sum of all the forces (motions) in the universe, except by creative power. And all that can be done by finite power is to set causes at work which will convert one or more forces into another or others, which can be reconverted again in turn back to their original form. Tracing then the force which exists in coal or other fuel, back as far as we may, we find that this force was formerly solar heat. This heat was converted into the organic or vital forces which formed the *sigillaria*,* since changed by other causes into coal. By bringing this coal in contact with the oxygen of the air, we initiate a reaction which causes the imprisoned force to reappear as heat-motion. This motion transmitted to the particles of water confined in a boiler gives rise to a molecular motion, which can be measured, and which we term, in common parlance, temperature. The motion of the particles is communicated upon the area of the piston of a steam engine forcing it along backward and forward, and this motion is transmitted through the connecting rod to the crank. The crank converts this rectilinear motion into a rotary one without changing its character as mass-motion, and so on to the lathes, planers, etc. It is in many cases difficult to recover the motion thus so often transferred, and finally partially reconverted into heat, as we shall presently see. But if we should substitute for the lathes, etc., a pump, we should be enabled to regain the mechanical power expended in the elevation of water as mechanical power, minus the waste consequent upon the imperfect construction of our machinery and the friction.

Friction produces heat, and must therefore be always understood to imply the production of heat. In the above case, therefore, we have the heat from our fuel again, partly as heat, and partly as mechanical work. If we now expend the mechanical work generated by the fall of the water raised by the pump in the production of friction by revolving disks or otherwise, we shall find that the heat produced by friction through the whole combination, added to that lost by radiation from boilers, pipes, etc., will exactly equal the heat derived from the coal. We have lost or gained nothing. In the case of the lathes, planers, etc., we have the friction of the tools and bearings which actually does convert the mass-motion partially back again into molecular motion or heat. This heat, if it could be collected and employed to warm the air of a room, would of course elevate its temperature, but it is usually expended in the expansion of the metals upon which work is done, in overcoming cohesion and in many other subtle ways. In the case where water is raised by the power of steam, the heat-motion is plainly seen to be converted into mechanical power. This power will, in its expenditure, give heat or other mechanical power, minus a certain amount of friction (heat). But it must be now evident to our correspondent that so long as it remains mechanical power it is not heat.

In dealing with light, we have to do with a still more subtle motion than heat; one not so easily traced in its various forms. Yet science has given us even here solid ground to stand upon.

Bodies either absorb or reflect light, yet in every reflection there is more or less absorbed. Absorption of light is not the soaking it up as a sponge soaks water, it is the conversion of light motion into other modes of motion, precisely as we have seen that heat is convertible into mass-motion. Both these forces may be converted into electricity, chemical affinity, or they may be converted each into the other. Suppose the walls of a room to be composed of the best reflectors known, and a flood of light to be admitted, and then all ingress or egress of light to be suddenly cut off. A series of reflections would take place. The light would pass back and forth from side to side of the room; a portion being absorbed, that is, converted into other motion each time, until finally entirely absorbed. When the enormous velocity of light is taken into consideration, it will be easy to see how this phenomenon would appear instantaneous in any apartment, unless its walls were so wide apart as to require a sensible time for the passing to and fro of the reflected rays.

We have thus endeavored to explain a subject, which to undisciplined minds is beset with difficulties. Its thorough comprehension is, however, a necessity to any who aspire to the mastery of the mechanical applications of either heat or light. "You cannot eat your cake and have it too." The sooner this fact is thoroughly understood, the sooner will the attention of man be turned from the delusive search after perpetual motions and like impossibilities, and directed to the only practical control man can ever have over the forces of nature—their conversion into different forms of motion.

WHAT IS AN AXIOM?

The standard acceptation of the word axiom is "a self-evident truth." If any proposition is self-evident, certainly it can not be made more evident by any amount of proof. There are some however that affirm an axiom to be an impossibility. Nothing say these philosophers is self-evident. As an example, consider the geometrical axiom "the whole is greater than any of its parts." To the majority of minds this seems perfectly self-evident, but would it seem so, if the fact had not been demonstrated in experience by the direct application of a part to the whole of a magnitude? Perhaps all so-called axioms may be susceptible of proof, and therefore not properly axioms. Be this as it may (and it is not our intention to go into a metaphysical discussion) it must be admitted that in any course of reasoning something must be taken in the outset for granted, if nothing more than the power of reasoning correctly.

But we have promised not to be metaphysical, and there is a practical point to which we wish to call special attention. Invention is a reasoning process. A result reached by accident is not an invention but a *discovery*. The patent laws of the United States and other countries do not make this distinction because such a distinction is impossible in the granting of patents to people, many of whom would be unable to say whether they were strictly inventors or only discoverers. It is however a real distinction.

Now admitting that an axiom is that which is to be considered as evident without *proof*, and that in every course of reasoning something must be taken as granted at the outset, it will at once be seen that great care is necessary on the part of inventors not to accept as an axiom that which is not entitled to be so considered. It is much better to err on the other side if errors must be made, and to accept nothing as true until a full demonstration of its truth is made. "Prove all things and hold fast to that which is good," is a maxim as useful in invention as in theology.

These thoughts were suggested by a case that has just come under our observation, where an inventor has spent a large sum of money in completing a machine, that is utterly worthless now that it is completed, and never would have been thought of had he not, as he said to us, accepted a certain supposed principle as an axiom.

True it is a subtle point and has misled many others beside the one whose mistake we now allude to, but accepted as a premise it has in this case led to much useless labor and expense.

It is important therefore that inventors should test every proposition, whether found in books or out of books, if the circumstances of the case permit such test, before applying it to any particular device. Works on hydraulic engineering abound; but every hydraulic engineer meets with phenomena seemingly unexplained by general principles contained in books.

Let us illustrate this by an example. Most are familiar with the Tantalus cup experiment described in nearly all elementary works on physics; the principle upon which it is based being that of a siphon which once filled continues to flow until the cup is emptied. If the siphon tube be small it will act, no matter how gradually the cup may be inclined; accepting this to be a principle applicable to siphons, an inventor of our acquaintance, made a machine to alternately fill and discharge by inclining it so that the water should flow over the bend of the curve. The tube in this case was a large one, and utterly refused to act as a siphon when the vessel containing the water was inclined slowly, and only acted when it was precipitately thrown from the perpendicular. But as anything like precipitate movement was under the requirements of the case inadmissible the invention came to naught. The failure in this case arose from supposing that siphons of all sizes act precisely alike, the effect of capillary attraction in small tubes being overlooked. Much money and time would have been saved in this instance if experiments with siphons of different caliber had preceded the construction of the machine itself. The fault committed in this case is one of constant occurrence. It was the assumption of a general principle from a particular application of a principle.

Such blunders can only be avoided by considering nothing as axiomatic, or as demonstrated, until it is decided by actual test. When this can not be attained, a risk must sometimes be taken, but no risk is necessary under most ordinary circumstances.

◆

SEAWEED CHARCOAL is now used as a substitute for animal charcoal, it is said, with good results.

---

* Sigillaria, or fossil-tree, one of those most abundant in the remains of the carboniferous period. See Prof. Dawson's lecture on "The Primeval Plants," page 5, current volume of SCIENTIFIC AMERICAN.

HAIR OF MEN AND ANIMALS—WHY NOT GROW OUR OWN HAIR?

Among the kindest provisions of Nature is the clothing she has supplied to animals. Having given to man superior reasoning powers and that wonder of delicate machinery the human hand, she left him to provide for his own needs in this respect. But lest he might lack for material, she gave to some species of animals a large surplus, from which man constantly draws to supply his necessities. Annually the meek and submissive sheep yields his coat that man may be clothed, and although the last century has developed a very extensive use of vegetable fabrics, we still depend in temperate climates very largely upon woolen textures, to enable us to withstand the extremes of cold we are forced to encounter.

But the sheep, although the most important of animals from which we derive clothing, is by no means the only animal who doffs his coat for man's use. The ox furnishes us with hair to stuff cushions and mattresses. The horse also contributes long, shining threads from tail and mane to be woven into various textures, of which the well-known hair cloth is chief. Even the hog supplies us with material for brushes. The lowly goose submits to cruel pangs and pluckings, her protestations and complaints being smothered by a stocking ruthlessly drawn over her head, that unthankful man may be luxuriously pillowed. Beside these, thousands of animals annually are deluded into relentless traps, or receive the fatal bullet, that their beautiful furs may contribute to the comfort and luxury of man.

There is a delightful sensation derived from the touch of soft fur, and to this, as well as its beauty of color and its pleasant warmth, it owes the esteem in which it has always been held. Savages who know nothing of weaving, instinctively resort to the furred skins of animals for clothing, while kings and potentates array themselves in the rare and costly ermine. In all lands and in all times, furs have been valued as articles of comfort and ornament. Not only the furs of animals and the feathers of birds have been applied to articles of dress and ornament for man, but human hair itself has for a long period been an article of commerce. Wig-makers are an ancient craft. Of late years many articles of real taste and beauty have been made of human hair, and a distinct art—hair jewelry—has arisen. The latest application of human hair to the adornment of heads incapable of supplying their own demand is the "waterfall;" but why *waterfall* has, we confess, always been a matter of profound mystery to us.

The result of the enormous demand for waterfalls has been to exhaust the natural supply of hair, and consequently the hair of animals, imitations of hair made from vegetable fiber and even the exhumation of mummies to rifle their dead scalps for the benefit of live ones, have been resorted to in order to meet the demand. The supply is notwithstanding still so limited that a little hair is made to become a large waterfall by plunging it over submerged rolls of sawdust in silk bags, and sundry other mysterious devices which only female genius could invent, and female fortitude endure.

The attention of the country has been called to the questions, "Why not grow our own silk?" "Why not grow our own sugar?" We now ask the attention of individuals to the question, "Why not grow our own hair?"

Hair may be likened to vegetable growth, and "each particular hair" to a plant, the skin being the soil from which it derives its substance. A hair is a hollow tube containing in its cavity an oil which gives it color. The only conditions necessary for its perfect and luxuriant growth, is that the soil be good and the growth of the crop be kept unrestrained by untoward circumstances.

If the soil is bad or has been deteriorated by disease, it must be renovated before good crops can reasonably be expected; but you might as well expect to improve the quality of land by casting stones upon it, as to renovate the scalp by the use of oils and pomatums. These compounds contain nothing to nourish the hair while they obstruct the action of the skin, upon the healthy condition of which, more than anything else, a full luxuriant growth of hair depends. The least harmful of oils, if any must be resorted to, is castor oil diluted with two parts alcohol and scented to suit the taste; but even this should be very sparingly used. A good healthy head of hair should supply its own oil. A preparation of alcohol one pint, pure glycerin two ounces, and water one half pint, scented with rose geranium, lemon grass, or any other essential oil suitable for the purpose, is an admirable dressing for the hair, and one that exerts a healthful influence upon the skin. A solution of borax is better for cleansing the hair than the bicarbonate of potash in common use by hair dressers for the purpose. The latter may be used to advantage, however, in warm weather, when acidity is apt to be generated by perspiration. Either of these will be rarely required if the hair and scalp are washed every morning in pure water, which is not only of great benefit to the hair, but the very best preventive of colds in the head. After each ablution the hair should be wiped nearly dry and then dressed, but exposure to cold winds before the hair is well dried is not advisable.

Another excellent detergent for the scalp is the white of egg. Two eggs will be sufficient for a cleansing of the hair, as ordinarily worn by men, but women who wear their hair as long as it will grow, will need four or more. The yolks should be carefully removed, and the albuminous portion rubbed into the roots of the hair very thoroughly for some time, when a thorough rinsing with water and drying with towels will leave the hair a beautiful luster and silky softness. Fine-toothed combs are only to be tolerated under conditions which are happily rare in this country, and therefore unnecessary to mention. Brushing is good, if not carried so far as to irritate the skin.

A gardener places blankets or other covering over plants to protect them from the effects of cold, but should he cover them in this way for the greater part of the time he would not expect them to thrive. Precisely analogous to this is the wearing of hats to protect the head from cold. Better never wear a hat than to wear it indiscriminately in-doors and out, as is the habit of many, who sit in offices or work in shops. It is perhaps a matter of doubt whether the head, covered by its natural clothing, requires any further protection whatever, and we are confident that the principal part of the baldness met with in civilized countries is to be charged to the heavy hats and caps in vogue. That there is some foundation for this belief is obvious from the fact that savages, who wear nothing on their heads, and women of civilized lands, who wear next to nothing, are rarely bald, except the temporary baldness resulting from sickness.

There is no element of beauty more important than beautiful hair, and it is absurd to suppose that any alteration that can be made in its color by dyes, adds to the general effect. The hair is one of the elements of complexion, and the thin delicate skins that look pure and healthy, with the adjunct of very light-colored hair, would become ghastly if contrasted with very dark hair. No matter what color the hair may be, it will be beautiful if it is of full growth and in a healthy condition.

A healthy condition of the hair also depends very much upon the general health. The skin and the internal organs are very intimately connected in their action. Many eruptions upon the scalp result from improper diet and imperfect digestion, and it is true of the hair as of the teeth, and all the other components of beauty, that it never can reach perfection without due attention to diet, exercise, regular habits, and all the requisites to perfect health.

◆

STUCCO WORK.

The method of finishing the outside of buildings in stucco, still prevails to some extent in this country, notwithstanding that in the Northern States the severe frosts of winter make sad havoc with it, unless, as is rarely the case, it be of the first quality in composition and workmanship. We are in receipt of inquiries from the Southern States as to its adaptability to the wants of that section, and the method by which it is applied.

With regard to the first point, we have little doubt that stucco will endure longer at the South than at the North, especially if it be of inferior quality. A stucco in common use is a compound of the grout or putty made of stone lime or burnt shells mixed with sharp grit sand. Its long exposure to the air has, however, a tendency to render it crumbly, and it is not an unfrequent occurrence to see it cleaving off in large scales, giving the building to which it is applied a most dilapidated appearance.

Much of this is to be attributed, as we have already said, to climate, but a great deal is to be charged to unskillful application and composition. The mortar should be most thoroughly beaten and worked before it is applied to the walls, and the strength of the lime should be well ascertained before the sand can be properly proportioned. Fixed rules for ordinary use in the mixing of this grout can not be given. Experience only can be relied upon as a guide for its composition. The lime may, however, be tested by slaking in the usual way. If fat it should slack rapidly and swell up from two to three and one-half times its original bulk, the rapidity of the slacking and the bulk after being slacked, being an index of the strength or fatness. The fatter it is the more sand will be required.

The best sand for stucco work is drift sand, and it is advantageous to dry it on iron plates, being careful not to push the heat so far as to discolor it. The grout being mixed should be parceled out into small portions and allowed to mellow for some days. It should then be thoroughly mixed into a soft pasty and spread thick upon the walls without any previous preparatory coat. It should also be thoroughly troweled down, as its durability depends very much upon the faithfulness with which this part of the work is performed. Too much stress can scarcely be given to this point, and thorough work should be insisted upon. Another coat should be put on before the first is dry, and this should also be well worked down. It will add much to the durability of this stucco if a coat of good boiled linseed oil be laid on after it is dry.

Various ingredients are recommended by good authority for the strengthening of stuccos, the basis of which is lime. Among these is sugar which is added, the proportions being about one pound of coarse sugar to eight gallons of water used.

There are many other preparations used for stucco work but although some of them are far more durable than the one we have described, they are for the most part too expensive to come into very general use. Among them are the well known Adam's oil cement, and the stucco made by mixing pulverized marble with lime or plaster and working it the same as ordinary plaster. A good cheap cement for stucco work may, however, be made by using good hydraulic cement and clean sand mixed in proper proportions and in such quantities that it may all be laid on before it has time to set. The sand should be dried and mixed in the proportion of one part of cement to two parts of sand by measure. In measuring, the sand should not be packed, but thrown loosely in the measure.

Previous to the application of any stucco, the joints between bricks should be raked out, say from three-eighths to one-half an inch. The surface should then be thoroughly swept to free it from loose dirt, and afterward wet with a hose or other convenient means, and the stucco applied before it dries. If difficulty is experienced in making the stucco adhere to the flat surfaces of bricks or stones, they may be chipped with a hatchet or mill-pick. The first coat should not extend so far that a second cannot be laid over it before it dries, and the whole should be shielded from the direct action of the sun's rays while drying.

As soon as dried the surface should be inspected by taps with a very light hammer. The non-adherent spots may be thus detected, and should be immediately torn off and replaced. The most important of all these precautions is, however, the thoroughness in troweling mentioned above, without which any amount of pains in other particulars will prove vain.

◆

THE LONDON UNDERGROUND RAILROAD.

The report of Mr. Calvert Vaux who was sent to London by the directors of New York City Central Underground Railway Company to examine into the construction and management of the Metropolitan Underground Railway of London, has been made public. The report is an interesting one and we gather from it some prominent facts which will interest our readers. The railway communications consist of the Great Western; London and Northwestern; London, Chatham and Dover; London, Brighton and South Coast; and Southeastern, on the south side. The total number of trains run each way, on the above roads, is 1,465, beside ninety trains run each way between Charing Cross and Cannon street. Part of the above trains carry passengers from one part of London to another; but it is estimated that the number of trains conveying residents to and from the suburbs to business is fully one thousand.

The suburban population accommodated by this number of trains on the north side is estimated at [illegible], and on the south side at [illegible].

The Metropolitan Underground Railway was projected about 1853, with the special object of lessening the great traffic through the streets of London, which was then becoming a very serious question, and also with a view to the establishment of a great central station for all the railways, and it was mainly through the exertions of the late Mr. Charles Pearson, a gentleman holding a legal position in connection with the corporation of London, that it was enabled to obtain a footing.

The length of the line from Bishop's Road to Moorgate street is four and a half miles, and from Edgeware Road to Brompton, at present opened, about two and a quarter miles, making six and three-quarter miles. From Brompton to Tower Hill, when finished, the length will be eight miles. From Brompton direct to Moorgate street, the distance is six and two-thirds miles.

Mr. Vaux gives an account of the connections worked by the Metropolitan Railway, by which it appears that a passenger from any station of the connecting roads can proceed to almost any part of London and its suburbs, or to England, Scotland or Wales, without going outside a station, and in many cases, without changing carriages.

About three miles, or two-thirds of the road is constructed underneath the streets, thus saving the purchase of property for that distance. The minimum depth of the rails below the surface of the streets is seventeen feet in covered way, and the maximum about fifty-four feet in tunnel.

There are fifteen stations on the Metropolitan Railway averaging half a mile apart.

As the works of the company are not yet finished, and the land purchases not all effected, the data for arriving at the cost of the Metropolitan Railway are necessarily incomplete; but as near as can be gathered from the half-yearly reports of the company, the cost of the line upon Bishop's road to Farringdon street, including land, works, rolling stock, etc., appears to be about seven and a half million dollars, or two million one hundred and forty thousand dollars a mile for two lines of way and a temporary station. Of this sum, one million a mile was for works of construction. If the company had been obliged to buy land for the entire route, it is estimated that the road would have cost over three millions and a half a mile.

Three hundred and one trains run over this road daily, one train every three minutes during the business part of the day. Each of the sets of trains is worked through from Moorgate street, without change of carriage or engine.

The number of engines employed is 36, and carriages 148. The engines have four coupled driving wheels and a bogie truck, and weigh, in working order, about forty-two tons, thirty tons being on the driving wheels. This great weight is necessary to enable them to get up steam quickly on leaving a station.

The fuel burned is a coke of a very superior quality. To enable a line with so much tunnel to be worked at all it is absolutely necessary that the engines should not give out any smoke or products of combustion while in the tunnel, and the engines on the Metropolitan Railway have been especially designed to meet this requirement. The steam is got up to 120 to 140 pounds pressure at the starting point, where the line is open, and when the train enters the covered way the damper is closed and combustion is practically prevented. The engine then continues to run on the steam already made so long as it is in the covered way, the pressure being generally lowered to eighty pounds when it emerges again into the open cut. The steam, instead of escaping into the tunnel, is conveyed by pipes to a condensing tank, which is filled with cold water at each end of the journey. Four carriages are usually run in a train. They weigh about fourteen tons when empty. The speed is usually fifteen miles an hour, including stoppages.

The line is worked by the electric telegraph, so that two trains cannot be on the same line at the same time between any two stations, thus preventing the possibility of collision.

[illegible]

[illegible] WHAT DOES A PATENT SECURE?

[illegible]

GLYCERIN—ITS USE AND ABUSE.

[illegible]

A few years ago glycerin was only known in scientific books. [illegible]

[illegible]

[illegible]

[illegible]

MANUFACTURING, MINING, AND RAILROAD ITEMS.

[illegible]

Answers to Correspondents.

[illegible]

Business and Personal.

[illegible]

Recent American and Foreign Patents.

[illegible]

[illegible]

Inventions Patented in England by Americans.

[illegible]

Official List of Patents.

Issued by the United States Patent Office.

[illegible]

88,312.—Fireproof Building.—Edwin May, Indianapolis, Ind.

88,313.—Fertilizer and Seed Drill.—Thomas E. McCaughey [illegible]

88,314.—Rolling Mill.—James Montgomery, Clinton Landing, N. Y.

88,315.—Farm Gate.—H. Parmenter, Grand Rapids, Mich.

88,316.—Washer Packing for Piston Rods and Steam Engines.—[illegible], Chicago, Ill.

88,317.—Machine for Sticking Pins.—T. Piper (assignor to Howe Manufacturing Company), Birmingham, Conn.

88,318.—Door Spring.—De Forest Powers, Waukegan, Ill.

88,319.—Putting up Caustic Alkalies.—J. [illegible] (assignor to himself, Daniel Pennock, and [illegible]), Philadelphia, Pa.

88,320.—Blowing Machine.—W. Reichenbach and E. Willey, Paris, France.

88,321.—Steam Generator.—Geo. H. Reynolds, New York city.

88,322.—Wrench.—F. C. Rowe, Boston, Mass.

88,323.—Vault Cover.—J. Ross, Brooklyn, N. Y.

88,324.—Punching Machine.—W. E. Scott and D. L. Wood, Terre Haute, Ind.

88,325.—Sled Brake.—H. W. Smith and S. C. Smith, [illegible], Pa.

88,326.—Reversible Latch.—W. E. Sparks and E. H. Sparks, New Britain, Conn.

88,327.—Tuyere.—W. L. [illegible], Benwood, W. Va.

88,328.—Mop Wringer.—A. D. Tate, Peekskill, N. Y.

88,329.—Cultivator.—J. C. Tobias and Wm. N. [illegible], Ill.

88,330.—Washing Machine.—J. B. Underwood, Parkersburg, W. Va.

88,331.—Medical Compound.—J. B. Vann, [illegible], Ala.

88,332.—Seed Separator.—Wm. J. Walker, [illegible], Ill.

88,333.—Fruit Picker.—J. T. Warren, Le Roy, N. Y.

88,334.—Cloth Press.—C. H. Weston and John [illegible], Lowell, Mass.

88,335.—Reed Organ.—A. W. Wilcox, New Haven, Conn.

88,336.—Mosquito Fan and Air Circulator.—James D. Wright, [illegible], assignor to himself and H. S. Wright, St. Louis, Mo.

88,337.—Parlor Ten-Pin Toy.—D. [illegible], New Albany, Ind.

88,338.—Reversible Collar.—C. W. [illegible], Clarksville, Ohio.

88,339.—Velocipede.—G. D. [illegible] and F. H. [illegible], Buffalo, N. Y.

88,340.—Hoop Skirt.—H. A. Ross, New York city.

REISSUES.

[illegible].—Griddle.—Dated August 25, 1867; reissue 3,279.—[illegible]

80,437.—Harvester.—Dated June 2, 1868; reissue 3,277.—[illegible]

12,914.—Seed Planter.—Dated May 22, 1855; reissue 3,278.—[illegible], Boston, Mass.

DESIGNS.

3,359 to 3,362.—Stocking Fabric.—T. [illegible], Philadelphia, Pa. Three Patents.

3,363 and 3,364.—Hinge.—F. T. [illegible], Boston, Mass., assignor to P. and F. Corbin, New Britain, Conn. Two Patents.

3,365.—Gate.—Lewis [illegible] (assignor to W. W. [illegible]), Philadelphia, Pa.

3,366.—Sled Runner.—T. L. [illegible], Kokomo, Ind.

PATENT OFFICES,

American and European,

OF

MUNN & CO.,

No. 37 Park Row, New York.

For a period of nearly twenty-two years Munn & Co. have occupied the position of leading solicitors of American and European Patents, [illegible]

[illegible] Wood Working.

Munn & Co. [illegible]

CONSULTATIONS AND OPINIONS FREE.

[illegible]

THE GREAT ADVANTAGES

OF MUNN & CO.'S AGENCY are that their practice has been [illegible]

WITHOUT EXTRA CHARGE.

Munn & Co. [illegible]

Caveats [illegible]

Reissues.—A patent, when discovered to be defective, may be reissued [illegible]

Designs, Trade Marks, and Compositions can be patented for a term of years; [illegible]

[illegible]

Patents can be Extended.—All patents issued prior to 1861, [illegible]

Interferences [illegible]

EUROPEAN PATENTS.

[illegible]

Address all communications to

MUNN & CO.,

No. 37 Park Row, New York city.

Office in Washington, corner of F and 7th streets.

Receipts.—When money is paid at the office for subscriptions, a receipt for it will be given; but when subscribers remit their money by mail, they may consider the arrival of the first paper a bona-fide acknowledgment of their funds.

City Subscribers.—The Scientific American will be delivered in every part of the city at $3.50 a year. Single copies for sale at all the News Stands in this city, Brooklyn, Jersey City, and Williamsburg, and by most of the News Dealers in the United States.

Advertisements.

The value of the Scientific American as an advertising medium cannot be over-estimated. [illegible]

RATES OF ADVERTISING.

Back Page .... [illegible] a line.

Inside Page .... [illegible] a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter-press.

$500 Will Buy the whole right of a [illegible]

ROBERT McCALVEY, Manufacturer of [illegible]
[illegible] Philadelphia, Pa.

DECALCOMANIE [illegible]

ARTIFICIAL EARS FOR THE DEAF— [illegible]

THE NOVELTY IRON WORKS— [illegible]

ENGINE LATHES—[illegible]

J. H. WILLAN'S PATENTS FOR IM- [illegible]

LABORATORY of Industrial Chemistry. [illegible]

L. & J. W. FEUCHTWANGER

CHEMISTS, 55 Cedar st., New York.

Soluble Glass, [illegible]

Ceramic Materials [illegible]

Best Manganese, [illegible]

PRATT, WHITNEY & CO., [illegible]

TAKE NOTICE MANUFACTURERS.— [illegible]

For Sale.

TWO Upright Tubular Boilers, [illegible]

OIL, OIL, OIL.

PEASE'S IMPROVED OILS!

London, 1862. PRIZE MEDALS. Paris, 1867.

Railroads, Steamers, and for Machinery and Burning.

F. S. PEASE, [illegible]

[illegible] Buffalo, N. Y.

N.B.—Reliable orders filled for any part of the world.

HUMBER'S

Strains in Girders.

AMERICAN EDITION.—In Press and to be ready shortly. [illegible]

D. VAN NOSTRAND,

No. 192 Broadway.

STUBS.

ILLUSTRATED PRICE LIST of P. S. Stubs' [illegible]

23261 TOWNS—[illegible] Agents Wanted. [illegible]

STEVENS' PATENT SELF-LUBRICAT- [illegible]

FOR SALE.— [illegible]

New Patent Mixer

FOR

WHITE LEAD, PAINTS,

Chemicals, Fertilizers, etc.

Also, All Kinds of Machinery for White Lead Works and Oil Mills.

SHAFTING, PULLEYS & HANGERS.

POOLE & HUNT, [illegible] Baltimore, Md.

Industrial Literature.

The Practical Draftsman's Book of Industrial Design, [illegible]

A Practical Workshop Companion for Tin, [illegible]

The American Cottage Builder: A Series of Designs, Plans, and Specifications, [illegible]

The Rudiments of Architecture and Building: [illegible]

Practical Illustrations of Land and Marine Engines, [illegible]

Practical Rules for the Proportions of Modern Engines and Boilers for Land and Marine Purposes. By N. P. Burgh, Engineer. [illegible]

The Practical Metal Worker's Assistant: Comprising Metallurgic Chemistry, the Arts of Working [illegible]

Pocketbook for Railroad and Civil Engineers: [illegible]

The Essential Elements of Practical Mechanics: [illegible]

The Marine Steam Engine: By Thomas J. [illegible]

[illegible]

HENRY CAREY BAIRD,
Industrial Publisher,
406 Walnut st., Philadelphia, Pa.

GRAY'S PATENT BRICK MACHINE.— [illegible]

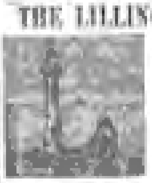
WOOLEN MILL TO RENT.— [illegible]

WATERS' PATENT FEED-WATER HEATER [illegible]

[illegible]

ELISHA FOOTE, Commissioner of Patents.

THE LILLINGSTON PAINT.



[illegible]

The Lillingston Paint [illegible]

Lillingston Paint, Pure White, is sold [illegible]

Address all orders and make all drafts payable to

LILLINGSTON PAINT CO.,

530 Water Street, New York city.

THE INVENTORS AND MECHANIC'S [illegible]

$10 A DAY for ALL. Stencil Tool, samples free. Address A. J. FULLAM, Springfield, Vt.

BOILER FELTING SAVES TWENTY-five per cent of Fuel. JOHN ASHCROFT, [illegible] New York.

STEAM HAMMERS, TURN-TABLES, and Foundery Cranes. Address GREENLEAF & CO., Indianapolis, Ind.

STEAM AND WATER GAGES, STEAM Whistles, Gage Cocks, and Engineers' Supplies. JOHN ASHCROFT, [illegible] New York.

STAMMERING cured by BATES' APPLIANCES. [illegible] SIMPSON & CO., Box 5076, N. Y.

PATENT RIGHT FOR SALE.— [illegible] Address [illegible]

$245 A MONTH TO AGENTS. [illegible] JOHN J. HOWARD & Co., [illegible]

H. BOARDMAN, Lancaster, Pa.—Superior [illegible] Machinery, [illegible]

PORTABLE
GRINDING MILLS,
MILLSTONES,
Bolting Cloth, Mill Machinery.
[illegible] & [illegible]

HOW SHALL WE
Paint our Houses?

Ready Made Colors for Painting Exteriors of Country Houses.

THESE Paints require only to be thinned [illegible] "RAILROAD" [illegible] Railroad Paint and Railroad Colors. [illegible]

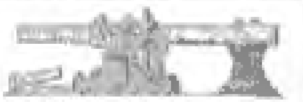
[illegible]

Proprietors of the [illegible] Manufacturers of White Lead, Zinc and Painters' Fine Colors.

[illegible]

BAIRD'S CATALOGUE OF PRACTICAL & SCIENTIFIC BOOKS

sent, free of postage, to any one who will forward his address to HENRY CAREY BAIRD, Industrial Publisher, 406 Walnut St., PHILADELPHIA.



LYMAN KINSLEY & CO.
[illegible]
Manufacturers of [illegible]

PAPER BAG Machines For Sale. Address [illegible] Boston.

LATHE CHUCKS—HORTON'S PATENT [illegible] E. HORTON & SON, Windsor Locks, Conn.

FOR STEAM ENGINES, BOILERS, IRON and Wood-working Machinery, [illegible] HUTCHINSON & LAURENCE, 8 Dey st.

Leather Belting.

[illegible]

30,000 ACRES

WESTERN and SOUTHERN LANDS and [illegible]

R. A. BELDEN & CO.
Manufacturers of Machinists' Tools, [illegible] New Haven, Conn.

EVERY MAN HIS own PRINTER.

[illegible]

THE MOST DURABLE AND RELIABLE [illegible] HUTCHINSON & LAURENCE, 8 Dey st.

WANTED! WANTED!

AGENTS of either sex, in every town and village, for the [illegible] C. THOMPSON & CO. [illegible]

Steam Engines, Steam
HAMMER, LATHES,
AND OTHER MACHINERY,
FOR SALE AT A GREAT SACRIFICE.

[illegible]

WOODWORTH PLANERS a SPECIALTY [illegible] WITHERBY, RUGG & RICHARDSON.

HOWARD'S SECTIONAL BOILER—[illegible] New York.

PAGE'S GREAT WATER FLAME COAL [illegible]

EARLY ROSE POTATO, AMERICAN AND [illegible]

RICHARDSON, MERIAM & CO.
[illegible] New York.

GARDNER'S GOVERNOR AND AUTOMATIC [illegible] GARDNER & [illegible], Quincy, Ill.

W. W. TUPPER & CO.'S PAT. GRATE [illegible] New York.

A MUSICAL BOX FOR ONE DOLLAR.— [illegible]

WROUGHT-Iron Pipe for Steam, Gas, and Water. [illegible] JOHN ASHCROFT, [illegible] N. Y.

Excelsior Lubricator.

PATENTED APRIL [illegible] [illegible]

Agents Wanted.

$75 TO $200 PER MONTH!!! [illegible]

Sheet and Roll Brass,
BRASS AND COPPER WIRE,
German Silver, etc.,
Manufactured by the
THOMAS MANUFACTURING CO.,
[illegible]

Bridesburg Manf'g Co.,
[illegible]
PHILADELPHIA, PA.
[illegible]

Sault's Patent
FRICTIONLESS LOCOMOTIVE VALVES, [illegible] New Haven, Conn.

BENT, GOODNOW & CO.
[illegible] THE PATENT STAR. [illegible]

WANTED—AGENTS—[illegible]

WANTED — AGENTS — To Sell the AMERICAN KNITTING MACHINE. [illegible]

PORTABLE STEAM ENGINES, COMBINING [illegible] J. C. HOADLEY & CO., Lawrence, Mass.

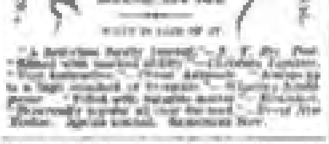
Power Hammers.
[illegible] PAT. Air Spring Hammers;
W. H. WATERS' PAT. Drop Hammers.
[illegible] CHARLES MERRILL & SONS,
[illegible] New York.

VELOCIPEDE WHEELS,
[illegible]
S. N. BROWN & CO.
Dayton, Ohio.
[illegible]

U. S. Patent Office,
Washington, D. C., [illegible]
[illegible]
ELISHA FOOTE, Commissioner of Patents.

U. S. Patent Office,
Washington, D. C., [illegible]
[illegible]
ELISHA FOOTE, Commissioner of Patents.

AGENTS, FARMERS, GARDENERS, and [illegible]



The Proper Study of Mankind is Man.
A PICTORIAL MAGAZINE
of
Human Science.
[illegible]
Ethnology, Physiology, Phrenology, Physiognomy and Psychology. Their application to Human Improvement.
The Phrenological Journal & Magazine, [illegible] S. R. WELLS, No. 389 Broadway, New York.
[illegible]

MODELS, PATTERNS, EXPERIMENTAL, [illegible]

Lucius W. Pond,

IRON and Woodworking Machinery, [illegible]

Radial Drills

AND Machinists' Tools. [illegible]

STOCKS, DIES, AND SCREW PLATES, [illegible] New York.

WOOD WORKING MACHINES.

[illegible] Philadelphia, Pa.

CAMDEN
Tool and Tube Works,

[illegible]

[illegible]'S
Patent Gauge Cock.

Agents wanted in every County. [illegible]

POWER LOOMS.

Improved [illegible]

GOODYEAR'S PATENT HUB BORING [illegible]

R. BALL & CO., Worcester, Mass., Manufacturers of [illegible]

BUERK'S WATCHMAN'S TIME DETECTOR.—[illegible]

ASHCROFT'S LOW-WATER DETECTOR [illegible] JOHN ASHCROFT, [illegible] New York.

SHINGLE AND HEADING MACHINE— [illegible] TREVOR & CO., Lockport, N. Y.

CORUNDUM— [illegible] Wilmington, Del.

ALCOTT'S CONCENTRIC LATHES,—For [illegible] S. C. HILLS, [illegible] New York.

SPICE CAN AND BLACKING BOX RIVETING Machines. W. PAINTER & CO., Baltimore.

PLATINUM. H. M. RAYNOR, [illegible] Broadway, N. Y.

IMPROVED LATHE DOG—Carries from [illegible]

Brick Machine.

LAFLER'S NEW IRON CLAD HAS MORE [illegible] J. A. LAFLER & CO., Albion, Orleans County, N. Y.

GLUE,
SAND PAPER,
Emery Paper & Cloth,
CURLED HAIR,
Ground Flint & Emery.
NEAT'S FOOT OIL.

FELTING for Covering Boilers and Pipes. [illegible]

MERRICK & SONS,
Southwark Foundery,
430 Washington Ave., Philadelphia, Pa.

MANUFACTURE NASMYTH & DAVY STEAM HAMMERS.

CORNISH PUMPING, BLAST, HORIZONTAL, VERTICAL, AND OSCILLATING ENGINES.

[illegible]

New York office, 62 Broadway.

WOODWORTH PLANER & MATCHER [illegible] S. C. HILLS, [illegible] N. Y.

MACHINISTS' Tools, Wood-turning Lathes, [illegible]

AMERICAN TINNED [illegible] Philadelphia, Pa.

MASON'S PAT'T FRICTION CLUTCHES [illegible]

IMPORTANT.

THE MOST VALUABLE MACHINE [illegible]

MORE IMPORTANT.

THE VARIETY, UNIVERSAL, AND ELLIPTICAL MACHINE [illegible]

EXAMINE YOUR BAIT BEFORE BITING.

[illegible]

For further particulars, before purchasing, address
A. B. & J. GEAR & CO.
NEW HAVEN, CONN.

[illegible] New York.

Advertisements.

[illegible]

The Gerner Boiler.

Stationary, Portable, Vertical, Marine.

30 PER CENT SAVED.

[illegible]

GREAT SAVING IN FUEL.

[illegible]

[illegible] & Co., [illegible] Agts.,

[illegible] Broadway, New York.

HAND POWER—[illegible]

INVENTORS' AND MANUFACTURERS' [illegible]

DRAWING MATERIALS. [illegible]

TUPPER'S PAT. FURNACE GRATE BAR [illegible]

L. B. TUPPER, [illegible], New York.

PUNCHING AND SHEARING [illegible]

[illegible] THE UNIVERSAL IRON HAND. [illegible]

FOUNDERS AND MACHINISTS.

The New American CORNET AND BAND INSTRUMENTS.

[illegible]

PATENT HAND-SAW MACHINES. [illegible]

TO INVENTORS AND OTHERS.— [illegible]

WM. D. ANDREWS & BROTHER,

[illegible] Water st., New York, [illegible]

[illegible]

Reynolds'

Turbine Water Wheels.

[illegible]

[illegible] Liberty st., New York.

INCREASE TWIST DRILLS, FLUTED [illegible]

EAGLE ANVILS AND PARALLEL CHAIN VISES

MANUFACTURED ONLY BY [illegible]

KIDDER'S PASTILLES.—A Sure Relief for Asthma. [illegible], Charlestown, Mass.

HELIOGRAPHIC

STEEL ENGRAVING AND PRINTING CO.

[illegible]

FREE.—Our New Catalogue of [illegible]

$200 A MONTH [illegible]

HOME INSURANCE COMPANY OF NEW YORK.

Office [illegible] No. 135 Broadway.

CASH CAPITAL [illegible]

[illegible]

[illegible]

CHARLES J. MARTIN, President.

[illegible]

BALL, BLACK & CO.

Nos. 565 and 567 Broadway,

OFFER AN UNEQUALED ASSORTMENT OF

Jurgensen, Nardin, Jacot, [illegible], [illegible], [illegible], [illegible], [illegible], Gardiny, [illegible], [illegible], Taylor, &c.

Also, a full line of American

WATCHES.

PATTERN LETTERS [illegible]

THE WILSON SHUTTLE SEWING MACHINE [illegible]

IRON PLANERS, ENGINE LATHES, [illegible]

Manufacturing Real Estate

FOR SALE.

LOT NO. 1. THE OLDEST ESTABLISHED FOUNDRY IN THE STATE, [illegible]

LOT NO. 2. THREE-STORY BRICK MACHINE SHOP, [illegible]

LOT NO. 3. THREE-STORY BRICK MACHINE SHOP, [illegible]

Address, BIGELOW MANUFACTURING CO., New Haven, Conn.

VALUABLE MACHINERY FOR SALE CHEAP.

The following are our lowest prices, delivered on Cars or Steamer, in New Haven.—

[illegible]

Address, BIGELOW MANUFACTURING CO., New Haven, Conn.

Genuine Waltham Watches.

SENT to any PART of the COUNTRY WITHOUT RISK to the PURCHASER.

Silver Hunting Watches, $18. 18-Carat Gold Hunting Watches, $80. Ladies' Gold Watches, $70.

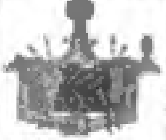
EVERY WATCH WARRANTED BY SPECIAL CERTIFICATE FROM THE AMERICAN WATCH COMPANY.

EVERY ONE TO WHOM WE SEND A WATCH HAS THE PRIVILEGE TO OPEN the Package and examine it, before paying the Express Co., and, if not satisfactory, it need not be taken. [illegible]

[illegible]

HOWARD & CO., Jewelers and Silversmiths,

[illegible] Broadway, New York.



BODINE'S JONVAL TURBINE WATER WHEEL. [illegible]

[illegible]

STEAM ENGINES

FROM 4 TO 500 HORSE POWER— [illegible]

WOOD & MANN STEAM ENGINE CO. [illegible]

THE TANITE EMERY WHEEL.— [illegible]

$20 A DAY TO MALE AND FEMALE [illegible]

GREAT ECONOMY IN

WATER POWER.

LEFFEL'S [illegible]

JAS. LEFFEL & CO., [illegible]

PATENT SOLID EMERY WHEELS. [illegible]

WIRE ROPE.

Manufactured by

JOHN A. ROEBLING,

Trenton, N. J.

FOR Inclined Planes, Standing Ship Rigging, [illegible]

FOR STEAM ENGINES, BOILERS, SAW [illegible]

CINCINNATI BRASS WORKS.— [illegible]

Philadelphia Advertisements.

[illegible]

The Harrison Boiler

THIS IS THE ONLY REALLY SAFE [illegible]

HARRISON BOILER WORKS,

[illegible]

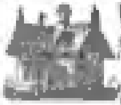
Wickersham's AMERICAN OIL FEEDERS.

PERFECTLY RELIABLE—[illegible]

J. B. WICKERSHAM, [illegible], Philadelphia.

B. F. STURTEVANT'S FAN PRESSURE BLOWERS [illegible]

IRON.—W. D. McGOWAN, [illegible], Pittsburgh, Pa.



WOODWARD'S COUNTRY HOMES. [illegible] Designs, $1.50, postpaid. Geo. E. Woodward, Architect, 191 Broadway, N. Y. Send stamp for Catalogue of all New Books on Architecture.

THE BEST IN THE WORLD.

THE

Scientific American

For 1869.

THE NEW VOLUME

Commenced JANUARY FIRST; [illegible]

The SCIENTIFIC AMERICAN has the Largest [illegible], and is the most Popular Journal in the world, devoted to Invention, Mechanics, Manufactures, Art, Science, and General Industry.

[illegible]

The SCIENTIFIC AMERICAN is [illegible]

STEAM ENGINEERING, TEXTILE MANUFACTURES, [illegible] AND SEWING MACHINES, AGRICULTURE AND AGRICULTURAL IMPLEMENTS, ARCHITECTURE AND BUILDING, WOOD-WORKING MACHINERY, [illegible] AND TILE MAKING, HEATING APPARATUS, CHEMICAL PROCESSES, DYEING, ETC., GLASS MANUFACTURE, HYDRAULICS AND PNEUMATICS, MILLS AND MILL-WRIGHTING, MINING AND METAL-WORKING IN ALL ITS BRANCHES, MECHANICAL AND CIVIL ENGINEERING, GAS AND PAPER MAKING, PHILOSOPHICAL INSTRUMENTS, HOUSEHOLD FURNITURE AND UTENSILS, RAILROADS AND CAR BUILDING, PHOTOGRAPHY, FINE ARTS, SPORTS, GAMES, TOYS—AND A THOUSAND THINGS OF INTEREST TO EVERY MAN, WOMAN AND CHILD IN THE LAND. THE PRACTICAL WORKSHOP AND HOUSEHOLD RECIPES ARE WORTH TEN TIMES THE SUBSCRIPTION PRICE.

Superb Illustrations

[illegible]

LEADING MANUFACTURING ESTABLISHMENTS, MACHINES, TOOLS AND PROCESSES.

Inventors and Patentees

[illegible]

Terms of Subscription.—[illegible]

[illegible]

Specimen copies will be sent gratis.

MUNN & CO., Publishers,

37 Park Row, New York.

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES

Vol. XX.—No. 8. [NEW SERIES.]

NEW YORK, FEBRUARY 20, 1869.

$3 per Annum. [IN ADVANCE.]

Combined Steam-lifting and Forcing Pumps.

In many localities, where ordinary pumps and necessary gear are employed to first raise and then distribute water, the whole machinery is multiplied, cumbersome, and costly; and the want of a compact, combined steam lift and force pump is apparent.

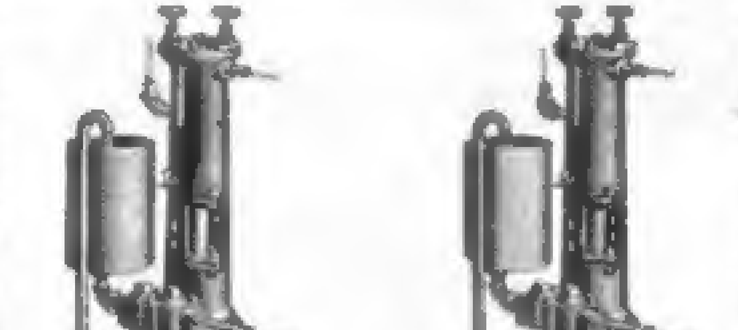
The engravings shown herewith represent two modifications of this useful combination—one a submerged pump, the other a pump with suction pipe leading in the desired direction to reach the well or source; each combination having for a motor a single steam cylinder with its piston and ram formed in one piece and provided with two separate throttle or regulating valves, to control the quantities or pressures of steam flowing through separate passages, to each end of the cylinder, suited to the character of the duty required. The ram is made to enter the force pump barrel, and has a reduced end passing through the bottom of the pump and stuffing box just below the channels leading to the valve box.

The engine and force pump cast and finished in one piece, is supported upon a cast frame with a base or channel plate, beneath which is attached a pipe in communication with the lateral channel formed therein; the connection of this pipe with the lift pump, forms a conduit for the same. The pump rod coupled to the protruding portion of the ram passes down through the conduit pipe and is guided truly within the pipe, when length requires it, by one or more ingeniously formed pipe couplings which have water-ways around a central boss or diaphragm, which boss is bored out to fit and guide the rod in its movements connected to the working parts of the lift pump.

When desired to operate, steam is admitted and regulated on its way, accordingly as to the depth at which the lift pump is placed, to one end of the steam cylinder, and the force of the resistance to be overcome to the other end of the cylinder, until the desired regularity of reciprocation is attained. The water is thus made to flow from the well or source up through the conduit pipe and lateral channel and pipes to the tank or heater. From the tank or heater the water is supplied at any temperature to the force pump, which delivers it into the boiler or other vessel, under pressure either from steam or hight of column.

It is obvious that the duty of either pump can be increased or lessened, or either pump can be worked separately, by withholding the supply of water from the force pump, in the one case, or by withdrawing the coupling key which connects the lift pump rod, in the other case.

The pumps shown in the engravings are single acting, but double acting ones are substituted, as required. For further information address Cope & Co., manufacturers, No. 118 East Second street, Cincinnati, Ohio.



COPE & MAXWELL'S STEAM, LIFT AND FORCE PUMPS.

* * *

THE ELLERSHAUSEN PROCESS OF MANUFACTURING IRON.

We recently noticed the fact that a new process of manufacturing iron was on its trial at Pittsburgh. This process we stated consisted in obviating the necessity of puddling, by mixing pulverized ore with the crude metal as it runs from the smelting furnace. The process is conducted at the works of Messrs. Shoenberger at the above city, and is the invention of Mr. Ellershausen. We alluded to the fact that we had obtained and tested specimens of the iron thus produced and found them of fair quality though slightly red-short, and promised to give the details of the process as soon as they could be obtained. The following is a description of this new method, extracted from *The New York Times*:

"The process consists in the conversion of crude cast iron, as it runs from the smelting furnace, into wrought iron, by the simple admixture of granulated iron ore. It is carried out at the works of Messrs. Shoenberger, at Pittsburgh, in the following manner: On the casting floor of the smelting furnace, a cast-iron turn-table, about eighteen feet in diameter, is revolved on rollers by a small steam engine. Upon the outside edge of the table stand a row of cast iron partitions, forming boxes, say twenty inches wide and ten inches high, open at the top. Just above the circle of boxes stands a stationary, wide-mouthed spout, terminating in the tap hole of the furnace. When the furnace is tapped the liquid iron runs down this spout, and falls out of it in a thin stream into the boxes as they slowly revolve under it, depositing in each a film of iron say one-eighth of an inch thick. But before the fall of melted iron reaches the boxes it is intercepted, or rather crossed, at right angles, by a thin fall of pulverized iron ore, which also runs out of a wide spout from a reservoir above. These two streams or falls are of about equal volume, say one-quarter of an inch deep and twenty inches wide. A workman, with a bar in the tap hole, regulates the stream of iron, and the iron spout from which the liquid metal falls into the boxes is removable; other spouts, previously coated with loam and dried, being attached to a common revolving frame, so as to be ready for use when the loam covering of the first becomes cracked or removed.

"The thin layers of iron and ore soon chill and solidify, so that by taking away the outer partition of the boxes (which form the rim of the turn-table) they may be removed in cakes of the size of the boxes, and weighing about two hundred pounds each. Four of these cakes or blooms are put into a reverberatory puddling or heating furnace, and raised to a bright yellow heat. They will not melt at this heat, but become softened so as to be easily broken up with a bar. The four blooms are formed, in the furnace, by the "saddle" of the workman, as in ordinary puddling operations, into eight balls. The balls are brought out, one after another, squeezed in the ordinary "squeezer" to expel the cinder and superfluous ore, and then rolled into wrought-iron bars, which are now ready for market, or for further reduction into smaller finished forms.

"The chemistry of the operation is as follows: The crude cast iron contains say five per cent of carbon and two per cent of silicon and more or less sulphur, phosphorus, and other impurities. In the Bessemer process, the oxygen of the air, blown into the liquid iron, combines with this carbon and these other impurities, and not only removes them, but leaves the pure iron in a liquid state, from which it can be cast into homogeneous masses of any size. In the puddling process, the oxygen of the air and of the ore or other "fettling" put into the furnace with the iron, combines with and eliminates the impurities, which are afterward squeezed out of the pasty mass by the squeezers and rolls. This process is long and comparatively expensive, because the mixture of oxygen or oxygen-bearing substances is not made intimate with the iron except by long stirring, which is not only skillful, but exhausting work.

"In the Ellershausen process the oxygen of the ore or oxide of iron (magnetic oxide is preferred) combines with the carbon and impurities, eliminating them as in the puddling process, and the iron of the ore increases the product. The chemical combination of the ore and the liquid crude iron appears to take place partly at the time of their contact when falling and lying upon the turn-table, and partly when the reheating occurs in the furnace. It seems impossible that a reaction which is so violent in the Bessemer process, and so prolonged in puddling, should take place so quickly and quietly in the new process; but the fact that the cakes of iron and ore do not melt by subsequent heating, as cast iron would, proves that its nature is changed by the first contact of the ore. The removal of sulphur and of phosphorus also seems more thorough than in the other processes. Analyses at different stages of the operation will throw more light on this question.

"The remarkable feature of the Ellershausen process is that absolutely no skill is required to carry it out. The proportion of ore mixed is intended to be about thirty per cent, but if too much is added, it is readily squeezed out with the slag, and seems to do no harm. The subsequent heating occupies about half an hour. "Puddle bar," the product obtained from the first rolling of the product of the puddling furnace is never marketable or finished iron. It is usually very ragged and seamed, and requires subsequent piling, reheating, and rerolling, to expel the impurities, and to give it soundness and solidity. The new process appears to produce merchantable iron at the first rolling, and at Pittsburgh, from a very inferior pig iron, made of one-half sulphurous Canada ores, and one-quarter Lake Superior and one-quarter Iron Mountain ores.

"The thoroughness and rapidity of the purification by this process, evidently depend on the intimacy of the mixture of iron and ore. This intimate mixture is also the essence of the Bessemer process. In fact, to Mr. Bessemer's original apprehension of this idea of intimate mechanical mixture, the greatest modern improvements in the iron manufacture are due."

The saving in cost was stated to us as averaging about six dollars per ton. The *Times*, from which the above was taken, states that it will amount to from ten to thirty dollars per ton, according to the materials used and the form of product required. We do not believe such a saving can be made, but events may prove us in error upon this point. As to the production of merchantable iron at first rolling, the article above quoted from is calculated to mislead, unless a great improvement has been made since we were at Pittsburgh a few months since. At that time the iron, although not puddled, was rolled more than iron usually is by the old method, although it was done at a single heat. The principles upon which the Ellershausen process is based are undoubtedly sound, but we are inclined to wait for further developments before admitting as much as is claimed for it.

* * *

Steel for Gravers.

A correspondent writes us that he finds difficulty in getting steel sufficiently hard and tough to stand, without leaving the graver too large at the cutting point. The tools referred to are used for the graduation of squares. He suggests that the steel described recently in our paper, entitled "New Steel," would be useful for this purpose. This steel has not, so far as we can ascertain, been introduced into this country yet. If it has, parties interested would do well to advertise it in our